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Improved Boring and Turning-mills.

We present herewith illustrations of two styles of boring and turning-mills built by the Betts Machine Company, of Wilmington, Del.

In many of their features these mills are alike, and possess the leading characteristics of the other machines built by this company, but differ, from the fact that the machine shown in the upper engraving is so built that the uprights can be run back, to greatly extend the capacity of the mill, which is 7 feet with the uprights in their normal position, and 10 feet when they are run back, while the machine shown below is a special 7-foot mill, arranged particularly for locomotive and similar work, and having the table provided with a universal chuck for holding wheel centers or tires. In this machine it will be noticed that there is a trough which extends around under the outer edge of the table, which catches the lubricant, which may be used in working steel, and returns it to a tank, from which, by a pump concealed from view, it is forced to a tank above, to be again used.

The mills, in which enlargement is provided for, have a somewhat greater length of cross-rail, and there is a blocking piece by which the tool bar of one of the heads is brought out to the center when the uprights are run back. The uprights are secured to the bed by bolts which move in T slots, and there are dowel-pins which serve to precisely locate the uprights again after they have been moved. In the larger sized machines there is provision for moving the uprights back by power.

In both machines the cross-rails raise and lower by power; all the sliding surfaces of the saddles on the rail and of the tool bars in the heads are flat and square with each other; the tool bars are so counterbalanced as not to interfere with the setting of the heads, and are fed by screws, and moved by hand with a rack and pinion movement; have a tool-holding device which admits of a tool being put in or removed as quickly as in the lathe, and with the same range as to position; heads entirely independent of each other as to their movements; great range of feeds with strong driving power; step bearings which can be quickly raised to lift the table off the annular bearing when small work or work requiring comparatively fast speed is to be done; uprights of the box or double plate pattern giving great strength with broad bearing surface for the rail upon them; and cut driving gears, with forged steel pinions of sufficiently large pitch and broad face to insure good wearing qualities. The table of either machine may be provided when desired with T slotted arms, which extend out from the table, and thus increase its effective diameter.

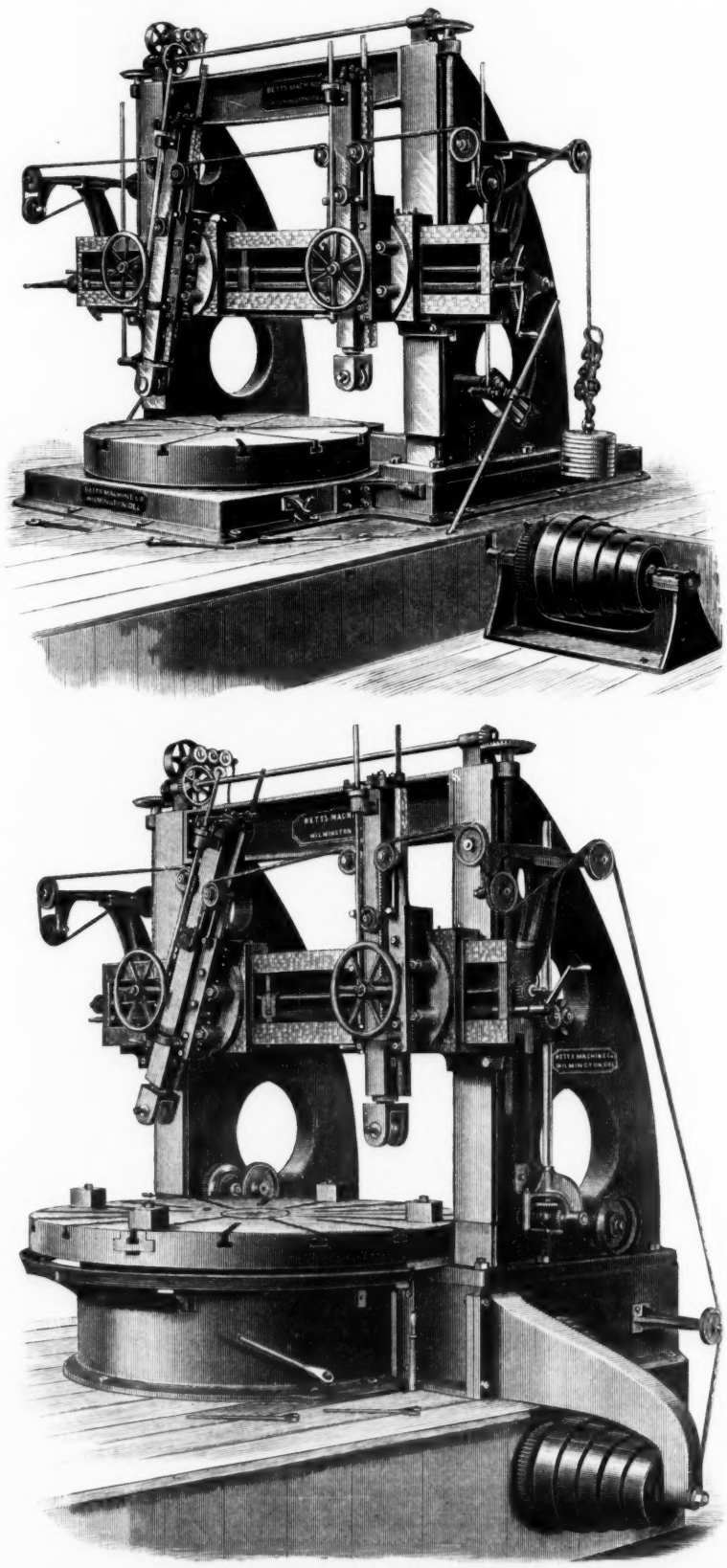
The chimney for the royal smelting works of Saxony is to be 460 feet in height, and to have an inside diameter of 23 feet at the base, tapering to 15½ feet. A flue, 1,093 yards in length, connects the works with the chimney, which is on a hill about 200 feet higher than the works.

The soda lakes of Natrona County, Wyoming, which contain deposits of solid soda twenty feet deep, have been sold to English capitalists for $2,000,000.

Accuracy that can be Practically Attained by Hand Work.

BY JARNO.

Even in machine work, much may depend upon the operator's skill. In a sense, hand work enters into every mechanical operation. In this paper the term, hand work, is applied to a class of operations in which cutting tools are held in the hand rather than in a machine.



IMPROVED BORING AND TURNING-MILLS.

Among the common tests of hand work in a machine shop, are these two: First, that in which the amount to be cut off is seen directly as a distance, as in measuring with a scale; and second, that in which the high places are rubbed and pointed out, either by coloring them, or by brightening. The first test combined with hand work forms a hand and eye operation, which we will first examine.

In this operation the guide for cutting is frequently a line, which, for accurate work, must not be coarse. The ideal line for the finest work is something that has form and position, but not breadth, which, of course, cannot be real. The finest lines, in a machine shop, are scratches in metal, and are simply narrow grooves. The term fine line does not, to every one, convey the same idea as to breadth of groove. Werner goes so far as to assert that it has no meaning other than to express a relation among lines of different widths, and that as a mechanical term it should be discontinued. On this rests a story. It all happened in this way:

Being in Brown & Sharpe's, and remembering Werner's assertion, I asked to see a fine line, wondering what would be the answer.

"One of the workmen at the bench will draw you some lines."

I approached a man with a thin, colorless face, black hair, large eyes, and long mustache. He answered my request with a smile half inquiring, half critical. In five minutes he handed me a piece of blackened sheet zinc on which were six lines varying in width from one to five one-thousandths of an inch. To my surprise, he had, at the end of each line, figured its estimated width in parts of an inch. He stuck a slip of paper over his figures. "The Professor will measure the lines, and figure the actual sizes."

I had no difficulty in picking out the Professor. His greeting was in a manner as if he were about equally dignified and annoyed. I should analyze him as compounded of parts of two very different men, and as having spent some of his leisure hours in reconciling one to another. We moved toward a micrometer microscope, and by the time we reached it he had subdued the annoyed manner, and along with the remaining dignity he showed a desire to do anything I wanted. He soon figured the actual sizes, and I uncovered the workman's figures. In one line the workman was right; in two others he varied a ten-thousandth of an inch; in the largest he varied less than one-thousandth.

From this experiment, and much other evidence, I conclude that any number of lines, not larger than these, can be drawn, by hand and eye, accurate in width to within a limit of a thousandth of an inch, and that a line can be drawn exact in position to the same limit. A line five ten-thousandths of an inch in width can be seen, in different positions, with the naked eye.

The "Professor" explains: "In this shop, the unit for most measurements is the thousandth of an inch. This unit should be employed in graduating scales and protractors, so as to avoid misunderstandings, and give the workman what he wants. Here is a scale having lines only one ten-thousandth of an inch in width. You can see them in a good light, if the scale is held in the right position. There, I see them now. I think that they are seen not as a width or size, but in consequence of the spreading of the rays of light as they reach the eye. Now, if these be fine lines, most other lines in this shop are coarse."

The "Professor" is evidently on a subject that is near his heart. His face has changed, and his eye is clearer, as if we might see more of what he is really thinking.

Some years ago I had occasion to see how closely a piece can be filed to a line. I had each of two men file a few pieces as nearly one inch long as he could see, on different days, looking through a common magnifying glass, and filing to the lines on a vernier

caliper bar. In any piece the variation was not more than one-thousandth of an inch, which, I conclude, is a practical limit, in filing to a line that is not more than four one-thousandths of an inch wide.

The "Crown" Roofing Double Seamer.

The accompanying illustration shows an improved tool made for use by roofers in putting on tin roofs. It is called the roofing double seamer, and is so arranged that it completes a double seam in four operations, which are performed consecutively without adjustment of the machine. In the first operation the seamer is held with the treadle at the left, and the handles are then drawn together until the first turn is completed. The machine is then reversed—*i. e.*, placed with the treadle at the right, and the treadle is then depressed by the foot to close the first seam. Keeping the machine in the same position, the handles are again brought together to make the first turn of the second seam, after which a movement of the treadle, as before, completes the second seam and the work. The machine is light and easily handled, being made of malleable iron, with the jaws accurately milled up. It is manufactured by W. H. Ermentrout, Reading, Pa., and is being introduced by Hall & Carpenter, Philadelphia.

The Crown Roofing Double Seamer.

Conveniences in the Machine Shop.

By A Mechanic.

In most machine shops we see great chances for improvement in cutting tools. I do not mean in the *kind* of tools, but improvements in grinding. Most workmen know how tools should be ground, but the conveniences for grinding in many places are so poor that the majority avoid grinding as much as possible.

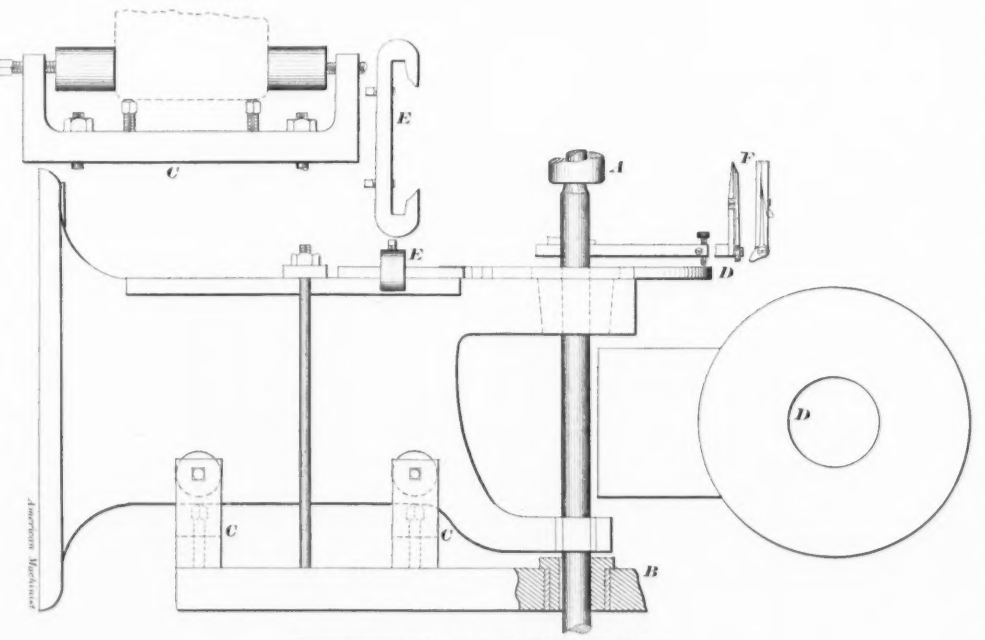
The best tools for taking big cuts are those with big points, for the large amount of stock absorbs the heat, and, besides this, such tools will stand if they are made harder than the light ones. Now, the wear on these tools is wholly on the point or edge, and in order to get this edge up again after wear, it is necessary to remove a large amount of stock; it is foolish to overlook this, for it is the cold truth. Most workmen "dub" such tools off on the point in their endeavors to get an edge with as little grinding as possible, for the grinding is such a disagreeable job. Now, what I am driving at is to offer a suggestion of how this disagreeable job can be got over.

The question is to grind off stock in the cheapest way. If we look through the large cutlery places where there is sharp competition, and where some things are made cheaper than some machine shops could afford to think of making them, we will find that they do their grinding on large grindstones, run at a high rate of speed.

If the cutlery places could do their grinding cheaper with emery wheels they would be very likely to discover it. I believe that in a machine shop where anything like heavy work is done, and, say where more than one hundred men are employed, that it would pay to have at least one large grindstone. Of course in a machine shop this should be well guarded with a big cast-iron hood, and it should also have provisions for cleanliness. I would not suggest any changes in the small stones, except for some places it would be well if they were kept true and clean. The large stone would be profitable for other work besides grinding tools. I know of one shop where they have a grinding room, and where tools are ground in about proper shape before coming into the machine shop. I think this is a good scheme. Emery grinders it seems are a kind of necessary evil for some work, but I would try to have these rigs as far as possible in a room by themselves, and provide there a good big exhauster to carry the loose grit away from the place. Some emery grinder advocates use some curious arguments. Here is one that I noticed not long ago: "The best has been improved." Now, it struck me that this is a case of misdirected energy. I think if we spend our time and means improving things that are now not the best we will do well, and also find lots of employment.

They tell us that all work is improved by grinding, for it is more accurate. We can fit a lathe spindle by turning in a good engine lathe, so that it will give perfect satisfaction in use. Perhaps we could discover with fine measuring instruments that our lathe fitted spindle is out of round about .00025 inch. Now, if we grind one so it will not be out of round more than .000000001 (you can add as many ciphers as you choose) would it be any better than the first? Remember that the first was perfectly satisfactory. For my part, I do not take any stock in perfection arguments, but would have an emery grinder for hardened work, and for such other cases as it would well apply. But I am drifting from my subject.

Jigs are in the line of conveniences. There are two reasons for using jigs—one is for convenience and the other is for greater accuracy. Now, the great accuracy reason, like the grinding, is only sensible when great accuracy is wanted, and this is not the case always. The greatest hold that jigs have in machine shops is in the line of convenience.



Conveniences in the Machine Shop.

There are two ways of making jigs. One is by using good judgment guided by good common sense, and by this way jigs are not very expensive, usually. The other way is the great mathematical theory, which says that everything shall be just standard, and that there shall be nowhere a possible error of more than .001 inch, regardless of the place or the size—whether the size was guessed at or not; in fact, nothing to do with reason or common sense, but only to follow the standard, whatever that may be. This way is very expensive, and no wonder.

There is a vast difference between machine shops and gun, watch or sewing machine factories. Some machine shops will contract to build almost anything in the line of machinery, from the smallest piece to a locomotive or a large marine engine; but let us see how they do business in the gun factory. Several years ago I was fortunate enough to pay a visit to the U. S. Armory at Springfield, Mass. The first thing that I noticed on going in was that I was not in a machine shop. I saw a machine shop there, though, where the tools were made, but the main shop was a factory, or rather a large imperfect automatic machine for making one kind and size gun. I say imperfect, for I noticed that there were missing links in the machine, that at the time of my visit were filled by human beings—that is, the links that should throw a piece from one machine to the other. I believe this machine will be perfected in time, so that a small machine shop to keep it in repair, and a president and treasurer, can run the whole place. If some of the large machine shops were to fit up for all their work the same as the gun factory is fitted, they would cover every square inch of the State of Maine with a two-story building, and as there would not be sale for such a large product the most of this place would be idle all the time; it will be quite a number of years before the difference between the machine shop and the factory is lost. This does not come under the head of conveniences really, but as so many people seem to see no difference between the machine shop and the factory, or else do not know where to draw the line, and as what I have to say refers to jig work requiring a line somewhere, I think perhaps this will serve to draw it. There are two ways of building machines. It is of great importance that sewing machines, guns, watches and such things be made on the interchangeable plan, and that plan, in order to be profitable, requires a factory like the gun place described. Every man who can carry a gun is not a mechanic, and he does not carry a gun factory with him usually, so when a part breaks he wants to be able to get a new piece to fit without much loss of time.

If a piston rod on a big marine engine breaks, the engineer would not expect to be able to go to any hardware store and buy a new one that would just fit, nor would any hardware dealer expect to make much money keeping such goods, for he would be fortunate if he made one sale during his lifetime. Now, hoping that the line is well, drawn, and that our chats about the good and the bad things in the machine shop will not be limited to anybody's standard, unless necessary, I will go ahead with the jigs and special fixtures. It is impossible to give any rules that will apply to all cases, so, in order to make my meaning clear, I will try to go through the building of a milling machine, and we will see how many conveniences we can work in, of a kind that will be suited to the machine shop, and as far as possible apply to different sizes of machines. The object of this is to show that very convenient tools can be made for a reasonable cost, and to show the necessity of thought in the machine shop. We have been over the planing part pretty thoroughly, so we will start at boring the standard for the spindle. This job can be done as accurately on a good upright drill press as on any ordinary tool in the machine shop. We will suppose in the illustration that *A* is the end of spindle, and *B* is a part of the bed plate of the drill press. The fixture *C C*, a side view of which is shown above, in connection with the two long bolts and strap, furnishes the means of holding the standard to the bed plate, and the set-screws allow of its being easily trued up. The truing is done by use of the sweep in the boring bar, and by a small circle, but I suggest for convenience the plate, a face view of which is shown at *D*, and the edge of which is shown in its place on the standard. The bottom of this plate can be planed true, and the face squared nice and true on a good true face plate on the lathe. This can be held in its place by the fixture shown at *E*. The object of this is not for greater accuracy, for a good machinist can true up one of these very accurately without this plate; but it is a convenience. A good machinist can use a screw in the end of sweep, but the indicator shown at *F* would be more convenient.

For the benefit of some shops where such boring is not done, I will say that a good way to arrange the lower bearing is to bore a large hole true, and then bush it so after wear a new bushing can be put in, and the hole be again accurate. Then use a sleeve for the bar to slide through, and keep the bar from turning in this sleeve by the use of a key in a spline. If we bore these holes by the use of single-ended cutters, the taper hole with a taper head, and not ream at all, we will get a good job.

The Germ of the Phonograph.

When the phonograph was invented by Mr. Edison we fancied that we had at last discovered something new under the sun. "Surely," we said, "the phonograph at least is new." We imagined that nothing like it had ever been dreamed of before. But there is where we were wrong again. Something almost exactly like it was invented when Edison was barely out of his cradle, and more or less dim premonitions of the modern marvel haunted the minds of men centuries ago. In the year 1859 the famous Abbe Migne read a paper before the British Association, describing an instrument called a phonautograph, which had but a short time before been invented by a young Frenchman, M. E. L. Scott.

The following is a quotation from the Abbe's paper, and may be found in the transactions of the British Association for the year mentioned above: "The phonautograph consists of a tube enlarged at one end in the same manner as a trumpet, in order to concentrate the sounds which are conveyed through it to a thin membrane tightly strained over the other end of the instrument. This membrane carries affixed to it an excessively light stylus or pencil, which is put in motion by every vibration produced by the action of the voice upon the membrane. Behind this stylus is a band of paper covered with lampblack, which is unrolled by clockwork, and as this band passes along the point of the stylus, traces are left in the lampblack of all the curvilinear and rectilinear movements originating in the vibrations of the membrane, thus producing in its own peculiar characters a faithful reproduction of the sounds."

This instrument was still in the rough, however, and the Abbe went on to explain that while it was fairly successful with

musical sounds, the human voice presented certain difficulties. Nevertheless he had little doubt that eventually the phonautograph would register for future generations not only the words, but the tones of famous actors and orators.—*St. Louis Republic.*

Sketches of an Apprenticeship.

BY W. S. ROGERS.

One day a man brought into the shop four light but large box tables made in one piece, of cast-iron. The top surfaces had to be planed, and they were just a little too large to go through the housings of our planers.

Of course the Old Man could have refused the job, but that wasn't what he was running the plant for, and our foreman had to scheme how to do it.

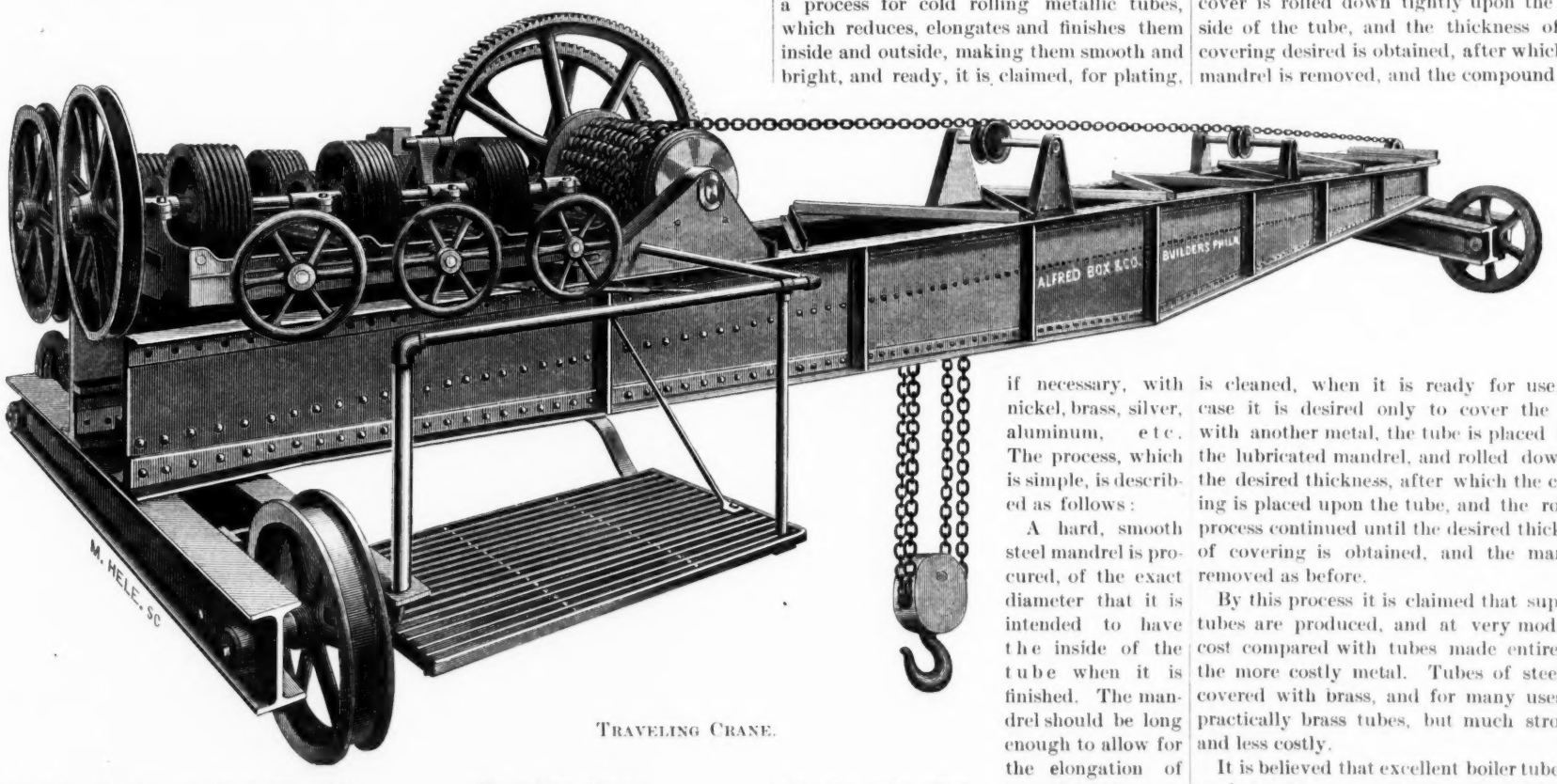
As the castings were too long and bulky to use an "overhung" tool, and were higher than the cross-rail when up to its highest limit, we cubs were watching Tom pretty close. After his boring and turning that big pulley we had absolute faith in Tom's ability, but we couldn't see how he was going to do this last job.

One morning two long box-shaped parallel strips resembling the cross-rail were brought in from the "no account" pile of stuff that had been accumulating for years in an outside shed, and laid by the big planer. Some long bolts and clamping strips were brought in from the smith shop; then Tom had a quiet talk with the jour. on the planer, and went away and left him. Still us cubs couldn't see through the problem, but feeling that a crisis had about arrived on that job we "kept our eyes barked," and did our best to have as much business as possible in that end of the shop.

After dinner the cross-rail was taken off and secured to the platen, bottom edge up, and made stiff by an angle plate behind it, a spring being fixed to the tool block, and held by a yoke around the clapper box. Then those parallel strips were fastened to the housings, a heavy casting swung up with the tackle block against the strips, the side to be planed underneath, and securely fastened with the long bolts and clamps. Last, a long rod, carrying two collars, was connected to the feed reverse at one end, the other end sliding through a hole in the handle on the cross-rail, and the scheme was ready. It didn't take much longer to do it than it has to tell about it. There was no fuss nor feathers made about it; Tom didn't rush to the office and have the Old Man come see what a great man *he* was. In fact, from Tom's actions one would have thought he didn't care anything about it.

Quite different were the actions of another chap that worked himself into a foreman-ship of a shop. A new automatic Brainerd gear cutter was brought into the works, and enough excitement and fussing was created getting that machine belted and running, to have paralyzed a Fourth of July celebration. None of the jours had sense enough to set the machine and adjust it, while all that he permitted a cub to do was just watch it run. In fact, that foreman spent hours, and, one might say, days of his time (which might have been valuable to his employer if he had known a foreman's duties) in managing an automatic gear cutter, and trying to appear as exceedingly smart in the firm's eyes, at the expense of the men under him. His jours were just as capable as Tom's, his apprentices just as bright and desirous of learning, but he would have appeared a smaller man if he had lifted the men higher in the firm's estimation. Well, his methods didn't declare dividends, and he left the place and worried considerable to find that gear cutter, without his wise supervision, went right along whittling out gears with a cub wrestling it just as well, if not better, than when he "engineered" it.

Tom's methods, I think, were the best. We were all battling in a common cause. Our leader was always in front, giving us credit for intelligence enough to carry on his plans, not behind us with the long pole of brute force prodding our weaknesses in order to bring out his own greatness. The big I and little u in a machine shop neither lubricates nor declares profits.



TRAVELING CRANE.

Traveling Crane.

The accompanying illustration represents a traveling crane which has some novel features of construction worthy of attention by those interested in cranes.

As will be seen, the bridge rests upon trucks at either end, which are connected by a shaft, which passes along the side of the bridge, not shown in the engraving, this shaft, together with the considerable distance apart of the wheels of the trucks, insuring uniform motion of the bridge, and avoiding any tendency to "skewing" on the tracks.

The trolley is placed within the bridge, and all the actuating mechanism is above it, thus giving a clear way for the trolley to move from one end of the bridge to the other.

At the extreme left of the bridge are seen two sheaves, over which a single 1¼-inch rope passes in such a manner as to drive the wheels and the shafts to which they are keyed in opposite directions. Each of these shafts has keyed to it three grooved friction wheels, and between the shafts, and a little below them, are three similar grooved wheels, each mounted in a sliding frame, which can be moved by a screw and hand-wheel, to bring the central wheel into contact with either of the revolving wheels. The three hand wheels, for starting, stopping, or reversing any of the motions, are seen at the side of the bridge, in reach of the operator. From these central friction wheels, motion is taken by cross shafts for moving the bridge, the trolley, or for hoisting. The chain from the hoisting drum runs along the top of the bridge over three grooved wheels, the two wheels nearest the drum moving freely on the shafts from side to side with the chain as it is wound or unwound, the fixed wheel at the other end of the bridge being at such a distance from the drum as to give no trouble from the chain riding or crowding out of the grooves.

In all bearings where it is practical to do so, roller bearings are used, which, of course, diminish friction, and avoid trouble from lack of attention and oiling; treatment to which cranes are often subjected.

The builders of this crane, Alfred Box & Co., Philadelphia, have built three cranes of this type, ranging from ten to twenty tons capacity, and up to 50 feet span, and their success has justified them in preparing to build them up to 100 tons capacity, as they are now doing.

Cold Rolled and Compound Metallic Tubes.

On June 10th, 1890, a patent was issued to George H. Everson, of Pittsburgh, Pa., for a process for cold rolling metallic tubes, which reduces, elongates and finishes them inside and outside, making them smooth and bright, and ready, it is claimed, for plating, if necessary, with nickel, brass, silver, aluminum, etc. The process, which is simple, is described as follows:

A hard, smooth steel mandrel is procured, of the exact diameter that it is intended to have the inside of the tube when it is finished. The mandrel should be long enough to allow for the elongation of the tube to be rolled. A good lubricant is then placed over the surface of the mandrel (good oil and graphite), and the tube to be rolled is placed over the mandrel, or the mandrel pushed through the hollow of the tube, letting the ends of the mandrel extend beyond the ends of the tubes. The tube is then rolled through hard surface rolls until the desired outside diameter of the tube is obtained, after which, the mandrel is removed, and the tube cleaned of the oil, etc. The tube is then found to be perfectly smooth and bright, and the metal very much condensed, causing it to be much stronger than before it had been through the cold rolling process.

There are a great many uses for which these cold rolled steel tubes are adapted, among which are mentioned, hollow shafting, the light weight of which makes it easy on the bearings, and saves oil; hand and foot railing, and bright fence work; fancy awning frames; bedsteads; chandelier work; pump linings; steam radiators; vault and safe door bolts; stay bolt irons; book rack rollers; anti-friction rollers; metallic wheel spokes; gas and water fittings, where fine appearance is necessary, etc.

The inventor, it is said, has produced very fine work in this line from common butt-welded steel gas pipe, as well as from copper, lead, brass, and other metals. The process is used by the Rolled Steel Carriage Wheel Company, of Pittsburgh, Pa., for producing the spokes for wagon and carriage wheels, which are made of steel.

On October 7th, 1890, a patent was issued to the same inventor for a process of manufacturing compound tubes, *i. e.*, tubes of one kind of metal covered or lined, or both, with other kinds of metal. For example, a steel tube covered or lined with lead, tin, brass, copper, aluminum, etc., done mechanically (not chemically). The covering or lining can be rolled outside or inside the tubes, any reasonable thickness desired. A description of this process is given also: First, to line a metal tube with another metal, a hard mandrel is taken, the diameter of which is the same as desired for the inside of the lining of the tube when finished. The metal lining is then placed around the mandrel, and rolled through or between hard surfaced rolls, until the lining is reduced to the desired thickness. Then the tube that is to be lined is slipped over the lining, and the rolling process continued until the tube is rolled tightly onto the lining, and reduced to the outside diameter desired, after which the mandrel is removed, and the tube cleaned.

If it is desired to cover the tube as well as line it, the mandrel is left inside the lining, the metal cover is slipped over the tube, and the rolling process continued, until the metal cover is rolled down tightly upon the outside of the tube, and the thickness of the covering desired is obtained, after which the mandrel is removed, and the compound tube is cleaned, when it is ready for use. In case it is desired only to cover the tube with another metal, the tube is placed upon the lubricated mandrel, and rolled down to the desired thickness, after which the covering is placed upon the tube, and the rolling process continued until the desired thickness of covering is obtained, and the mandrel removed as before.

By this process it is claimed that superior tubes are produced, and at very moderate cost compared with tubes made entirely of the more costly metal. Tubes of steel are covered with brass, and for many uses are practically brass tubes, but much stronger and less costly.

It is believed that excellent boiler tubes are made by this process, by covering steel tubes with copper. The copper is, of course, placed next to the water, to avoid corrosion, and the cold rolled steel surface next to the heat, as better calculated to resist the action of the sparks and cinders. In making the joint in putting these tubes in a boiler, the copper acts as a gasket or ferrule between the tube and the boiler head, making a tight joint.

A gentleman whose lungs are not strong enough for him to enjoy the fumes of tobacco after a dinner party, took with him to a friend's house a little lamp which he sat on a table when the cigars were lighted. Over the flames of this little lamp was a ring of platinum which became red-hot in a very few seconds, and which consumed the smoke of a dozen cigars as fast as it was made, so that the atmosphere of the room was as clear as it would have been had there been no smoking going on at all.—*Poughkeepsie Eagle.*

The silk industry of the country is said to be in a dull condition, and no material change is anticipated for some time; manufacturers say not before next fall. Some of the mills running on specialties are fairly busy, but these are the exception.

On the Development of Punches and Dies.

By A. Webster.

An examination of the punched pieces that enter into the manufacture of a watch, as they come from the punches and dies, shows a wonderful skill in the manufacture of such tools. Many of the pieces leave the dies almost finished, and for cheap watches, in a condition ready to be applied to the watch, without further labor upon them.

Fig. 1.

Fig. 2.

Fig. 3.

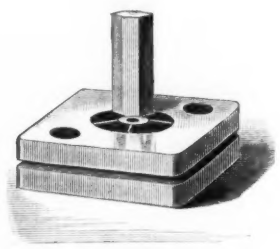


Fig. 6.

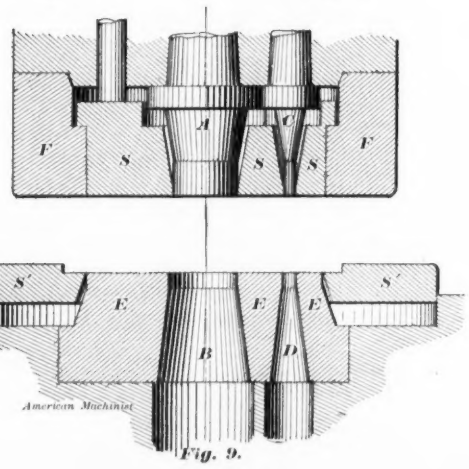


Fig. 9.

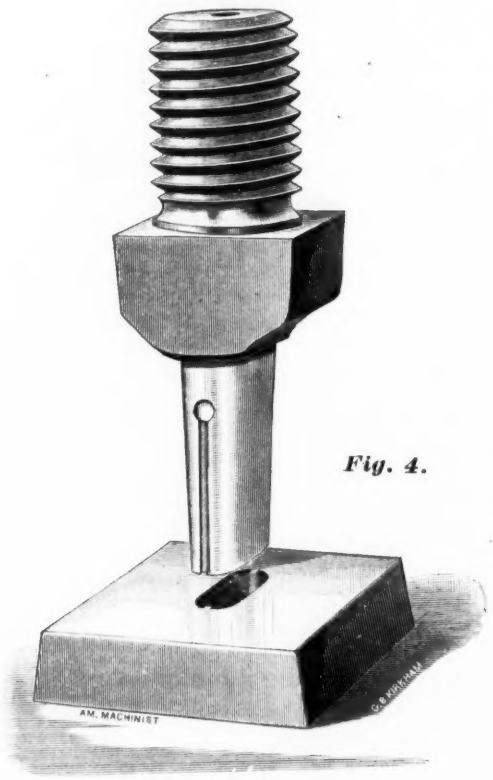


Fig. 4.

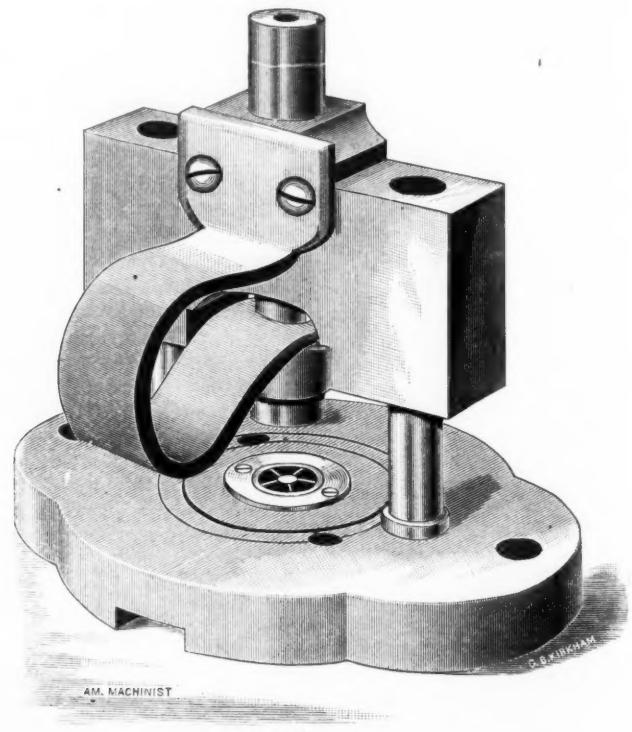


Fig. 5.

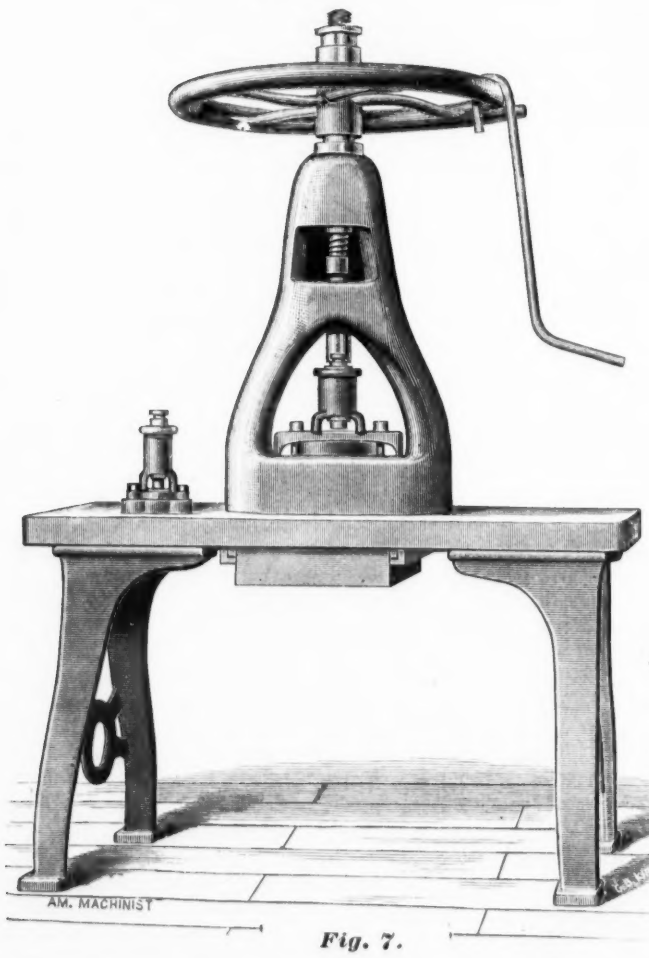


Fig. 7.

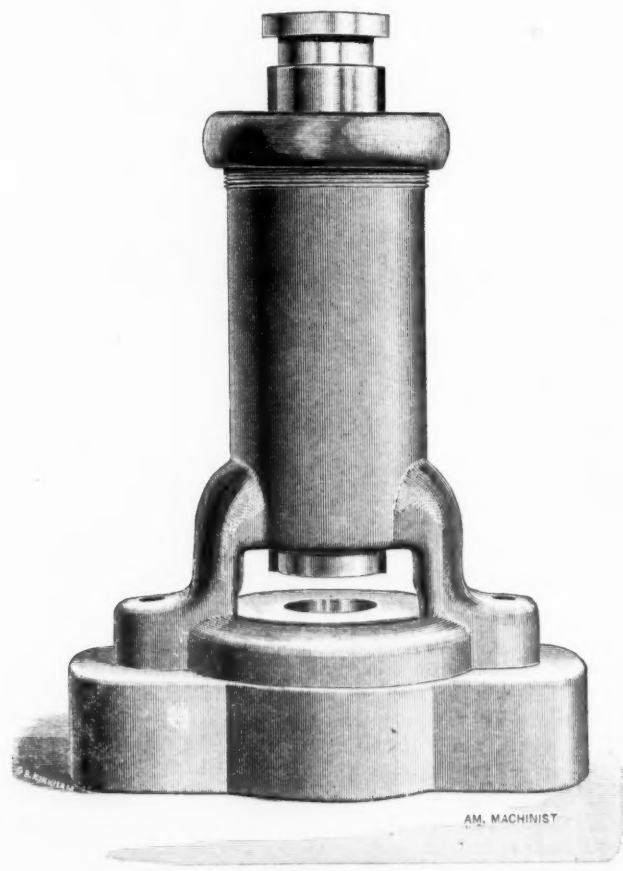


Fig. 8.

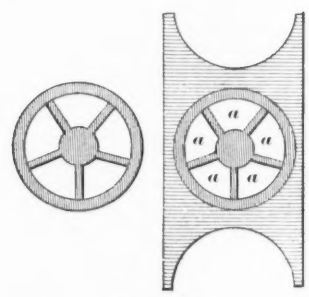


Fig. 10.

Fig. 11.

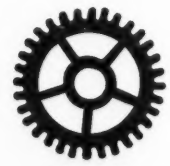


Fig. 12.

Fig. 13.

The punches and dies used in watch-making are divided into what are termed the *plain*, the *double*, and the *compound* punches.

Cuts Nos. 1, 2 and 3 show articles punched by compound punches, *i. e.*, punches and dies which punch the outside and the holes at the same time—the blank or outside being punched upward, the holes being punched downward. By this process the die also becomes a punch, and the punch becomes a die. In other words, the top and bottom pieces are each both punch and die.

To the thoughtful mechanic this suggests the inquiry, "What may have been the steps of development, from the crude method of laying a piece of sheet-tin upon the grain end of a piece of wood, and driving a nail through it, thus forming a hole, to the result as shown by these improved processes?"

I propose, in a short, concise article, aided by illustrations, to give a description of the development of punches and dies.

Cut No. 4 shows the common method of making a punch and die, the punch being screwed solidly against its shoulder into the moving "gate" or piston of a hand or power press, the die being placed under the punch, which is then lowered into the hole in the die, and the die holder firmly clamped in place. When all of these operations are properly done there is but little risk of the punch being injured by coming in contact with the die, but the looseness of the "gate" of the press, necessary to give proper freedom for motion, and the side strain on the lower end of the punch, often bring the corners of the punch and die together, and both are ruined. Expensive punches and dies for watch work must not be subjected to this risk.

Mr. A. L. Dennison, the "father" of the watch industry of the United States, designed what is termed a "subpress." The oldest of these designs is shown in cut No. 5, which was made to punch watch wheels. The pins acting as guides for the moving part of the subpress, being at quite a distance from the center of the wheel, were far better guides than if the punch was put into the moving piston of the press. This punch and die was used for crossing or spoking the wheels after the blanks had been punched out.

The difference between this and the wheel punch and die used in England at that time, and, in fact, still used there, and seen by the writer in 1889, is shown in cut No. 6. The process is to take a round blank, and with a fiddle bow drill a hole in the center of this blank, placing this hole upon a center pin in the jig-like die, and then driving the punch through each of the openings, stamping out the five sectors, and thus forming the arms. A pair of dividers is then inserted in the center hole, and circles struck around the hub, and the inside of the rim, and the hub and rim filed to these lines. The workman seen working in this way was evidently about sixty years old. In response to the inquiry of the writer, he said that both his father and grandfather before him had used similar punches and dies for wheel work, and he seemed proud of this fact.

No better illustration of the conservatism of English methods can be given than to compare this English punch and die with the punched wheels shown in cuts Nos. 10, 11 and 12, which, with the exception of the one shown by Fig. 11, are made at a single operation, which is more quickly and more accurately performed than any one of the numerous operations by the English workman on similar work. The latest form of subpress is shown in cuts Nos. 7, 8 and 9, one being in position in a hand screw press, and one shown detached on a table beside it.

Cut No. 9 shows a compound punch and die made to punch a disk 1.25″ diameter, with a hole in the center .4″ diameter, and a side hole .08″ diameter. *E, E, E* is the die for punching holes *B* and *D*. It is also the punch for punching the outside diameter. *A* and *C* are the punches for punching the holes, and *F, F* is the die for punching the outside diameter. *S, S, S* is the shedder for ejecting the blank from the die *F*. *S'* is a shedder for removing the stock from the punch *E, E, E;* the pieces punched out pass through the holes *B, D* in the die.

The operations for punching are as follows:

As the piston of the subpress moves downward towards the punch, the shedders, being held in the position shown by springs, yield until the work is accomplished. The springs are powerful enough to return the shedders to the position shown, and usually force the piece punched back into the stock.

The latest American system of wheel punches and dies gives a result as shown in cut No. 10, where a strip of sheet metal is passed between the punches and dies, and at one motion of the press the sectors *A*, *A* are punched downward, and the wheel itself punched upward from the stock, thus creating what is termed a crossed wheel at one motion of the press. Over 20,000 of these wheels can be punched in one day, and a punch made by the American Watch Tool Company for the Waterbury Watch Company is known to have punched several million wheels. Comparing this instantaneous creation of a wheel, with the methods practiced by our English brethren, is it any wonder that we are now able to send watches to England in large quantities?

There are sixty pieces in a subpress to punch wheels, shown in cut No. 10. All the pieces that go to make the hole, the hubs and the inside of the rim are ground perfectly true after hardening, and arranged in such a manner that the hole, the hub, and the rim are perfectly concentric.

Cut No. 11 shows (full size) the finest-armed wheel of the watch, viz., the escape wheel. These wheels are first blanked, and afterwards passed through a second punching, which shaves the inside of the rim and the sides of the arms, so that they present a finished surface, instead of the ragged, torn surface usually left by punching.

Cut No. 12 shows (full size) a toothed wheel, spoked, and the center hole punched in a compound press made by the American Watch Tool Company for the Parker & Whipple Clock Company, of Meriden, Conn. These wheels are so nicely punched that they are used in the clocks without any further labor being expended upon them. The top of the tooth in this wheel being round, and not epicycloidal, is caused by the fact that it is a driven wheel, being driven by a very small pinion. I believe this to be the highest result of the American system of punch and die work.

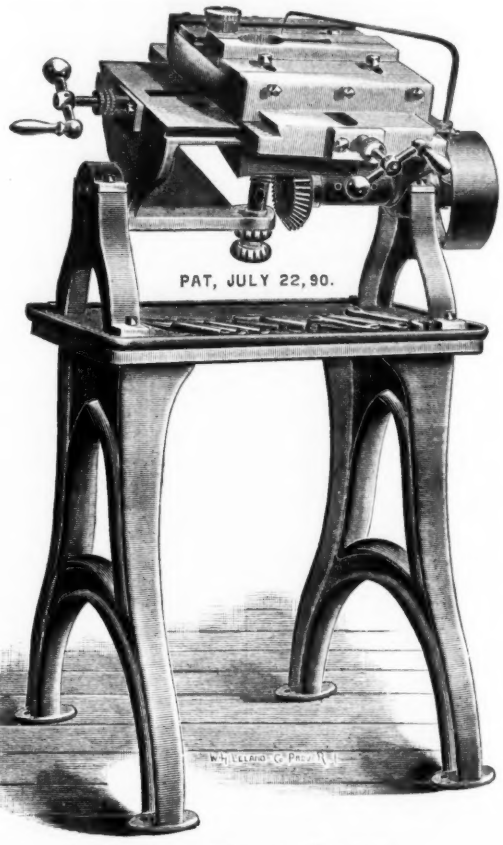
Cut No. 13 shows (full size) another punching for the Parker & Whipple Clock Company. All the holes shown are punched at one motion of the press, and are the holes for the pillars and pivots of a clock. This work is done so nicely that there is no necessity for any subsequent labor upon the piece. In this punching it is absolutely necessary that every hole should stand in a fixed relation to the three oblong holes, and this end is secured much more accurately by punching than is done by jig drilling, for, as the hole in the jig wears larger, while the drill is wearing smaller, this accumulated wear soon allows the drill to take a position at one side, and the depthing of wheels and pinions is thus caused to vary, whereas in the punched holes the wear of the punch simply reduces the size of the hole, and does not affect its position.

In the execution of this work it has been necessary to employ workmen with the keenest sense of what is meant by perfection, and in many watch factories these men have remained on the "punch and die job" for many years. They are the highest paid journeymen in the watch industry, and the value of this high grade of work has become appreciated by other manufacturers, until type-writer manufacturers and clock factories find it to their advantage to adopt the system, and Swiss and English watch manufacturers are now coming to this country to learn from us how we accomplish this work.

A writer on physiology asserts that the human body generates enough heat during the day to melt forty-four pounds of ice and raise it to the boiling point. Probably the professor had been experimenting with a manufacturer who had received a half dozen "countermanding" letters in his morning mail.—*Shoe and Leather Reporter.*

An Inverted Milling Machine.

At the shops of the Thurston Manufacturing Company, 419 Eddy street, Providence, R. I., a representative of this paper recently saw a number of milling machines, some in use and others in course of construction, which represented such a radical departure from the usual practice in milling machine construction as to attract immediate attention.



AN INVERTED MILLING MACHINE.

The machine is built especially for manufacturers of jewelry, or others who have numbers of blanking or trimming dies to make.

The principal features of the construction of the machine will be understood from the engraving, in which it is seen that the frame proper is supported upon gudgeons at either side, which are clamped in their bearings, and serve to hold the frame in any desired position, *i. e.*, horizontal, or at any desired inclination in either direction. The object of this is simply for the convenience of the operator, and so that he may secure upon the surface of the work, and the lines drawn upon it, the best possible light.

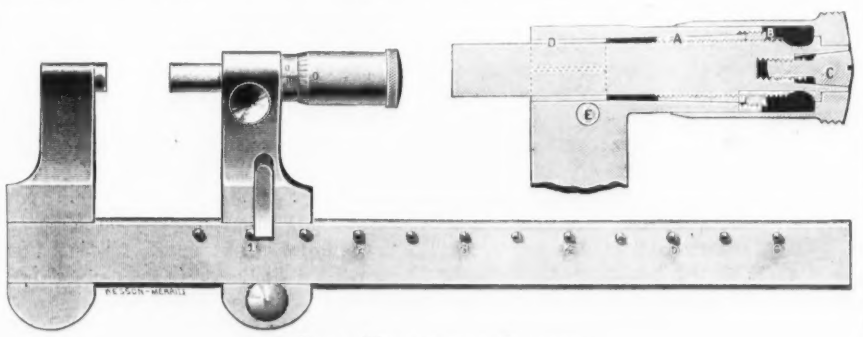
Through the right-hand gudgeon passes the shaft, on which is placed the driving pulley; at the other end of this shaft is a bevel gear, which, by means of another bevel gear, drives the spindle.

This spindle is vertical, and has a vertical adjustment. It carries, at the upper end, the mill by which the cutting is done, this mill being of the ordinary stem-cutter type, with taper shank, and with the cutting portion also tapered to suit the amount of clearance desired in the die. This cutter projects through an opening in the bottom of the chuck, over which opening the work is placed. The chuck is moved in either direction by means of the two slides and screws at right angles to each other, and thus, by means of the crank handles, the lines laid out on the surface of the work can be accurately followed. It is necessary only to drill one hole through the portion of the die which is to be removed, and the cutter, started in at this hole, removes the entire center in a single piece, as shown by the engraving, where the bowl of a large spoon die has been cut out and placed on top of the die when the machine was photographed. The pointer seen at the right always remains in a fixed position with regard to the cutter, so that where, for any reason, the cutter is below the surface of the work, and therefore out of sight, the pointer indicates its exact position. This is found to be especially convenient in cases where a sharp corner is to be made in a die, when the cutter can be lowered a little and the cutting continued, guided by the pointer, thus leaving but very little to be filed out. The machine is so designed and fitted up that the movement of the slides is smooth and under perfect control, special provision being made for taking up all lost motion. As would be expected by any mechanic experienced in such work as this machine is designed for, it has proven in use to be very efficient and satisfactory in every way. Two sizes are built, the smaller of which will finish a plate 6 inches wide, ⅝ inch thick, and any length; the larger machine, 10 inches wide, 2½ inches thick, any length.

A Beam Micrometer Caliper.

The accompanying engravings show a new micrometer caliper, which is manufactured by the Standard Tool Company, Athol, Mass.

As will be seen, the tool consists of a beam upon which there are two heads or jaws, one of which is fixed while the other slides along, and can be clamped at any point, according to the size of the work to be gauged. The edges of the beam are beveled, and the sliding head is fitted to it closely without a gib, and is open on the front side, as shown, being tightened in position by the screw seen at the bottom, one side of the head of this screw being flattened at an angle to fit the beveled edge of the beam, so that it acts as a gib.



A BEAM MICROMETER CALIPER.

At intervals of half an inch along the beam are placed small pins, one side of these pins being flattened, and, by a process of trial by standard-end measure pieces, these flat surfaces are made precisely one-half inch apart after all the rest of the work on the tool is completed. In the side of the moving head is a small key, which is let into a slot formed by milling, the slot being somewhat longer than the key, so that when the latter is pushed up to the top of the slot it will clear the pins in the beam, but when pushed down it comes into contact with them, and the two together then serve as a stop to locate the head on the beam. The key is drawn down to its place in the slot by a knurled head screw, which is on the other side, the sides of the slot being tapering, and the key so made that it does not quite bottom, the tapering sides serving to accurately locate it when the screw is tightened. This key does not touch the beam, but just clears it, so that after the key is drawn down to its place by the screw the head can be moved up against one of the pins, and clamped by the screw at the bottom. The micrometer screw is, of course, only one-half inch long, and, as shown by the sectional view of this head, is entirely covered. It is fitted to the nut *A*, which is tapering outside, and split, so that, when forced in by the small threaded ring *B*, it is closed on the screw, and thus adjustment for wear is made. As now made, there is another threaded ring at the other end of the nut, which prevents the nut being accidentally forced in by a blow on the end of the screw, as might happen with the construction shown.

A new method of adjusting the screw, so that it will read zero when the contact points are brought together, is used, by which the screw in the fixed head, commonly called the anvil, is replaced by a pin, which is driven into place, and need not be moved afterwards, the adjustment being made by means of the screw *C*, which is tapped into the end of the micrometer screw, as shown, and the end of the micrometer screw is bored out tapering, and split, so that when the screw *C* is tightened it expands the end of the micrometer screw and tightens it in the shell. Thus, when the micrometer is to be adjusted, the points are brought together, and the shell is then turned on the screw until it reads correctly when the screw *C* is tightened up.

The plain portion of the micrometer screw passes through the sleeve or bush *D*, which is split part of the way from the back end, and a cut also made part way around it at the bottom of the first cut, so that when the screw *E* is tightened the micrometer screw is held rigidly in place. One of these tools, which we were given an opportunity of examining, seemed to be in every way a very satisfactory caliper. They are made in two sizes, to measure 4 and 6 inches.

A Western correspondent encloses us a clipping from the London *Engineer*, in which some ridicule is heaped upon unreasonable claims made for aluminum, and asks: "Will it pay me to invent a flying machine that would be dependent upon the extremely low specific gravity and enormous strength of aluminum?" Whether it will pay to "invent" such a machine will depend largely, in our opinion, upon the definition given to the word "pay." If he means to ask if he will ever be able to do much flying with such a machine, we believe the proper answer to be no. If, on the other hand, he means to ask if he can find men willing to invest money upon a plausible scheme, on paper, to construct such a machine, it is very probable that, if he is a plausible talker, he will be able to make it pay. And in all probability the wilder the scheme the more money he will find ready. For a carefully written article on the subject of aluminum we refer our correspondent to our issue of February 5, 1891.

It is said that the man who never made an ocean voyage can always give prospective voyagers a sure remedy for seasickness. What a parallel this has in mechanical matters.

LETTERS FROM PRACTICAL MEN.

Melting Iron.

Editor American Machinist:

I always read all letters from men of experience and practice in the iron business, and while I usually agree with the majority, I find many things to disagree with; and as bringing up the contrary side is what we all look for, I will take that side for the time. In your issue of February 12, Mr. Charles Smith gives us some common sense directions especially serviceable in running a small foundry; but while I agree with him in the main, there are some points upon which we differ.

For instance, he contends that better results can be obtained in a foundry melting six or seven pounds of iron to one of fuel, than in trying to melt nine or ten pounds to one of fuel. In this we differ, as I can show him our records, which are carefully kept; or a visit to our works will convince him, by ocular demonstration, that we melt daily from twenty to forty tons of iron, with an average of eleven and two-tenths pounds of iron to one of fuel. In a 36″ cupola, seven to nine pounds is good melting, but in a cupola that lines up 48″ to 60″, anything less than nine pounds shows a defect in arrangement of tuyeres or strength of blast, or in charging up.

If Mr. Smith, or any other of your readers, will correspond with me, giving me the dimensions of their cupola, I will give them my opinions free gratis, which, coupled with their own experience, may lead to better results.

F. P. Wolcott,
Supt. Colwell Iron Works, Carteret, N. J.

Interchangeable Chucks.

Editor American Machinist:

In your issue of Jan. 8th I notice some sensible remarks by "A Mechanic," on the subject of Screw Threads on the Nose of the Lathe Mandrel. This subject was debated for nearly two years in the correspondence columns of the *English Mechanic*, beginning in Vol. XXXVIII. As one who took an humble part in that discussion, I send you the following notes of the line taken, and the conclusions that seemed to me to be reached, in case you should deem it of sufficient interest to place before your readers.

The discussion began through a proposal by Dr. Edmunds, a member of the Amateur Mechanical Society of London, that the makers of high-class lathes for eccentric or ornamental turning should adopt a particular form of lathe nose made on the interchangeable system, so that a person possessing such a mandrel could at any time order a chuck from his own, or any other maker, or borrow a chuck from a friend, and use it upon his own lathe, with the certainty of having it run true. Here, then, is the first answer to "A Mechanic's" question, "What is the matter with what we have already got?" The matter with us in England is, first, that we have not yet got this exchangeability, but must send our head-stock, or mandrel, to the maker, if we require a new chuck fitted with perfect accuracy.

Ornamental turners, however, require to go a little further in this direction. They have, very frequently, to mount one check upon another, and sometimes a third upon these. In order to be able to do this, and yet have the work run as truly as when first roughed out and surfaced upon the mandrel, requires workmanship of a very high degree of accuracy, and to meet the difficulty, Messrs. Holtzapffel have made some very ingenious transfer chucks. Dr. Edmunds describes these in the *English Mechanic*, and argues that, however ingenious, they ought not to be required, and would not be required if the mandrel nose were perfectly formed and finished. A further desideratum is that we should be able to rough out a piece of work in a plain lathe, and then be able to transfer it to the mandrel of the complete lathe on which it is to be finished or ornamented by eccentric cutting, etc., and still have it run true.

Dr. Edmunds proposed that, instead of threading the whole length of the nose, there should be formed at its root a short cylindrical fitting of a slightly larger diameter than the top of the thread, and about ¼ inch long, and that this fitting, and the face of the mandrel against which the chucks bear, should, after hardening, be accurately ground to gauge; that all makers of ornamental turning lathes should use a similar gauge in finishing their mandrel heads, and that the centering of the chucks should not depend upon the accuracy of the screw thread, but upon the plain surfaces, which can more easily be finished with perfect truth. It would of course be necessary that every chuck, to be interchangeable, must have an internal fitting made to the size of the short cylinder on the mandrel, and that this fitting must be equal in accuracy to that of a plug and ring gauge, or the system will fail, the slightest amount of shake being evidently fatal.

It was this consideration which led to the proposal to merge the shoulder and cylinder into a cone, an idea which was taken up very warmly, and argued at great length. Seeing that the screw threads on mandrel and chuck might interfere with the set of the conical surfaces, and would also prevent their being fitted by rubbing them together, there followed a number of proposals intended to do away with the screw threads. A narrow key or collar passed through the two cone fittings to draw them together renders the bored mandrel useless; a bayonet fitting and several other arrangements, more theoretical than practical, were proposed, and then, the fact being admitted that the threads of the nose did in themselves constitute a cone, or rather a succession of quasi-conical surfaces, the arguments turned upon the possibility, or otherwise, of finishing the threads of nose with a degree of accuracy approaching to that of a cylindrical surface. Some correspondents having argued that this should be done by a V edged lap set at the angular rake of the thread, others proved that if the sides of the V were straight, then the sides of the thread would be slightly hollowed, whether the angle was that of the bottom of the thread or the top, or midway between. The difficulty of insuring a perfectly true thread, having its surfaces as accurate at the cylindrical surface of a Whitworth gauge, led again to the idea of eliminating altogether the interference of the screw threads, by adopting for the lathe nose *the buttress thread*, shaped so as to hold the chuck up to the cylinder and face fitting of Dr. Edmunds, without having any (or hardly any) power to interfere in centering the chuck. A lathe was made on this plan for a scientific amateur, but most correspondents seemed to think it was too wide a departure from the usual practice.

I have reserved for the last the plan which commended itself most to my own mind. An old correspondent, "O. J. L.," threw out the idea that the kind of fitting made for self-centering chucks might be the right thing, and another, "J. L. D.," suggested that all transferable chucks should be made with an exactly similar shallow recess at the back, and that with every lathe should go a flange accurately sized to fit them all; the time required to insert the three screws which pass through the flange into the body of the chucks could be saved by making three short slots in the flange, each ending in a hole through which the heads of the screws could be passed, so that they would only require half a turn each to fix them. If it be objected that this is but another form of transfer chuck, I grant it, but suggest that the flange might be formed in one with the mandrel, its front and edge hardened and ground true, and then any chuck of metal, or even of wood, could be easily fitted to it, by simply turning a recess, and boring and tapping three small holes for the screws. The flange would itself serve as a catch-plate, and its being a permanent fixture appears likely to interfere with nothing but the ring of the oval chuck. By this means additional chucks could easily be made by plain turning, the only requirement being a flat circular template the exact size of the flange on the mandrel, having in it three holes, to be used for sizing the shallow recess in the back of the new chuck, and marking the places for the tapped holes. The size of the flange should insure a more perfect result, even, than the short cylinder of Dr. Edmunds, and the difficulty of correcting the screw threads would be completely got rid of; new chucks might be made even more easily than at present, with the advantage of perfect interchangeability.

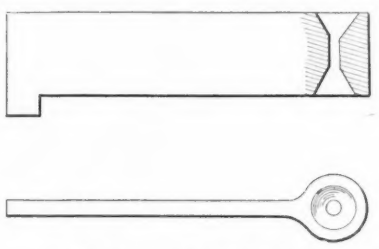
The best way out of the difficulty with the oval chuck ring that occurs to me, is to adopt the French form of oval chuck, which has no ring.

I hope that some of your ingenious correspondents will think it worth while to pursue the subject, and that we shall arrive eventually at interchangeable chucks as well as centers. The larger chucks only would be mounted upon the flange; smaller ones, wire chucks, etc., would be fitted into the hole for centers.

May I ask what are the methods for detecting and eliminating that form of error in screw threads known as "drunkenness"? I wish also to know how it is that the noses on American lathes are screwed to such a fine rate; our chucks sometimes give trouble by sticking, how much more, then, must yours? Whitworth uses a *coarser* thread than his usual rate for bolts.

For noses of 1¼″ diam., 6 threads, 10″ swing.
" " " 1⅝″ " 5 " 12″ "
" " " 2″ " 4 " 14″ "

F. A. M.
25 Grange Rd., Eastbourne, England.



An Alignment Gauge.

Editor American Machinist:

In your issue of Jan. 22d, 1891, you show a cut of an alignment gauge for lathe centers. I enclose you sketch of one I made several years ago; it may be an old idea, but I have never seen one like it. It is the simplest thing of the kind I ever saw, and works perfectly. Being simple to make, it is well adapted for apprentices to practice on while working their way up and collecting a set of tools; in fact, it is an acquisition to any machinist's "kit."

It is best made of steel about four inches long. First, a small hole the size of a small center hole should be drilled through at *a*, then each side should be reamed out with a center reamer, care being taken not to ream too deep, so that, when placed in the lathe, the centers will not meet. In use, a pair of calipers should be set to go just between the end *b* and the face plate. By trying the calipers in different positions around the circle, it can readily be seen if the back center is out of line. If the face plate does not run true, it should be turned so as to try the calipers at the same place every time. Trusting this may be of benefit to some of your readers.

A. L. C.

A Chattering Lathe.

Editor American Machinist:

A few days ago I was given a job to do; it was turning cone pulleys with the steps hollowed in for round belts. I selected one of the several idle lathes in the room and did the job all right until I came to make the half circle in the steps, which was 1 1/16″ wide and ⅜″ deep, when I found that the work chattered so that it resembled a knurled hand-wheel; screwing down the bearings and keeping the tail spindle tight was of no use. Finally an old jour. suggested that I use that lathe (pointing to an old-fashioned lathe with wooden bed and chain feed, while the lathe I was using was one of the latest type, and had only been running six months). So I laughed at him, reasoning with myself that a tumbled-down looking thing which everybody gave a wide berth to could not do what the latest improved one couldn't. But he insisted that I try it, which I did, having little faith in it, when, much to my surprise, it turned without a chatter, requiring very little filing, so smooth was the surface. I asked the jour. to explain the reasons to me, but this he was unable to do, so I write to your paper, trusting that you will answer my questions, explaining the cause, in your American Machinist.

An Apprentice.

Providence, R. I.

[Our apprentice friend may console himself with the reflection that he is by no means the first one to be puzzled to account for such phenomena as he describes, but in a general way it may be said that vibrations in machine tools are usually caused by weakness of some of the parts, or from mere lack of sufficient weight to prevent them. But when a light machine is being used it is often found that the interposition of some comparatively soft substance—such as wood or leather between the tool and the rest—will prevent vibration and chattering, which is probably due to the fact that vibrations depend largely upon the elasticity of the vibrating parts, wood and leather having very little elasticity. It may thus happen that a lathe bed composed largely of wood may vibrate less than one of iron, though at the same time it may actually spring and yield more under the strain of the cut. In finishing work, such as cylinder heads or covers, using a hand-tool, chattering is often stopped by simply putting a piece of leather belting on the rest under the tool, and a piece of wood placed under a tool in the tool-post will often stop chattering. The reason for this is evidently the fact that the leather and wood, being comparatively inelastic, do not transmit vibrations.]

Use the Same Engine in Both Cases.

Editor American Machinist:

Answering your correspondent G. G., it would seem the best plan to make the same engine do the work in both cases, and to so vary the conditions of its working as to allow an economical performance at either load.

Probably the best type of engine for the power named would be the high-speed single valve automatic, now so familiar.

A 7″ cylinder would be ample for the maximum load (20 H. P.), and by reducing the number of revolutions (readily accomplished by a change of the governor springs), and carrying a lower boiler pressure, the engine would work with a fair degree of economy at 10 H. P. load.

In shifting from 10 to 20 H. P. the only changes necessitated by this plan would be a new set of governor springs, and a smaller pulley on the engine.

This entirely avoids alterations in foundation and pipes which would follow a substitution of one sized engine for another.

R. S. B.

Would Plan for Two Engines.

Editor American Machinist:

The question of "G. G.," in a recent issue, and which you so kindly submit to such of your readers as care to blaze away at it, is a very interesting one, and has often been submitted to the writer during his past twenty years' practice.

While columns might be written on this subject, and a lengthy discussion pro and con be had, I, as one who realizes that time is slipping by mighty fast to us old fellows who are on the down grade of life, wish to offer my mite from a practical standpoint of weight and measure.

While I realize that it may be said that I "beg the question," yet my advice has, in most cases, been to put in as a starter the 20 H. P. boiler and the 10 H. P. engine, and then in piping from the boiler to engine, and for exhaust, etc., use pipe suitable for the 20 H. P. The foundation for engine, if such has to be built, should also be laid up for the 20 H. P., then when the larger engine has to be installed the only extra expense is the possible cost of a simple cast-iron bed-plate.

It must be borne in mind that it is a fairly good investment to have a boiler a trifle larger than is actually needed for these small

powers, and this is so obvious to every practical engineer in charge that it seems unnecessary to enlarge on this point. But an engine too large for its work is an extravagant thing for the man who pays the coal bill. It is also well understood by men of practical experience that a well-built engine, after five years' use, when offered for sale by itself, will bring a higher relative price than when offered in connection with a boiler that has been in use the same number of years, because of the life of an engine being much greater than that of a boiler.

W. H. ODELL.

That Traction Engine.

Editor American Machinist:

The accompanying sketch (Fig. 1) is supposed to represent, in outline, a traction engine, having two cylinders arranged as shown, instead of only one, as they are usually built. The cylinder *a* is so situated that its crank-shaft is vertically over the driving-wheel axis, while cylinder *b* is level with the axis, or, in other words, its vertical distance from the center of the driving axle is *nil*. Now these cylinders being of the same size, and geared to the driving-wheel in the same ratio, will, of course, have the same power to propel the engine, and, as a necessary consequence, it seems to me, the same tendency to lift the engine off the front wheels when moving forward. The answer to Question No. 78, issue of February 12, seems to assume that the lifting power of the cylinder depends upon a leverage gained in some way by vertical distance above the center of the axle. If this is so, then it must be that cylinder *b* in the accompanying sketch will have no lifting power at all, for there is no vertical distance between it and the axle. And if it have no lifting power, it is evident that it can have no propelling power. The fact is, it seems to me, that so long as the ratio of the gearing remains the same, and the weight and position of the center of gravity also the same, vertical distance between cylinder and axle can have no influence on either the propelling or lifting force, any more than horizontal distance between them could have in the case of cylinder *b*. It is, of course, evident at a glance that, in analyzing the forces acting in such an engine, tending to lift the forward end, we may ignore that which acts on the cylinder heads of the cylinder *b*, for they act in a direct line with the axle, and can therefore produce no direct turning moment. This is not so readily apparent in the case of cylinder *a*, though by analyzing the forces acting at the various points of engagement of the teeth and upon the axles of the gears, it is evident that these forces are all balanced in each case until we come to the last gear which engages with the driving gear, where we find an unbalanced force acting upon its axle, and tending to lift the engine off the front wheels, and this unbalanced force must be overcome by the weight of the engine, to prevent lifting. This will, I think, be true of any possible arrangement of the gearing, so long as the ratio of the gearing remains the same, and the weights are the same and similarly distributed.

Another point: According to the answer, if the distance from the center of the driving axle to the center of gravity of the engine remains the same, and other things are equal, the tendency to lift will be the same. In Fig. 2 the circle may be supposed to represent the driving wheel of such an engine. In one case we will suppose the center of gravity of the engine to be located at *a*, in which position it will be apparent that the maximum force will be required to lift the engine in front with a given weight, and with the center of gravity of the engine at the given distance from the center of the axle. Now suppose an engine of the same weight, and geared in the same ratio, according to the conditions stated in the answer, but to have its center of gravity at *b*, which is vertically over the driving axle, but *at the same distance from it*. It would be evident that in such a case the engine would be in unstable equilibrium, and the minimum force would be required to lift it in front. It must, therefore, be apparent that something else must be looked out for in the placing of the center of gravity, besides merely its distance from the center of the axle.

T. A. PANDIE.

[We thank our correspondent for his honest criticism. For the purpose of making the subject plain, we have appended Figs. 3 and 4. The question is simply this: Which of these two engines will have the greatest power of lifting the front end of the engine off the ground, the steam pressure, size of cylinders, and ratio of gearing, being equal in both cases? In comparing the powers of lifting the front ends under these conditions, we must admit that the vertical distances from the center of axle to the axes of cylinders will have no influence on the lifting powers, and in this respect our correspondent is correct in his statement. But when we wish to determine what that lifting power is, we must take into account the leverage with which the pressure on the crank axle acts to produce rotation about the driving axle. This leverage is equal to the sum of the radii of the driving wheel *K*, and the wheel *L* on the crank-shaft. If, for instance, the radius of the wheel *K* is 24 inches, and that of the wheel *L* is 6 inches, we have then a leverage of 30 inches, or 2.5 feet. If, now, the pressure on the crank-shaft *L* is 1,000 pounds, we have then a moment of $2.5 \times 1{,}000 = 2{,}500$ foot-pounds to produce rotation about the driving axle. To prevent rotation, the moment of the force of gravity must at least be equal to 2,500 foot-pounds.

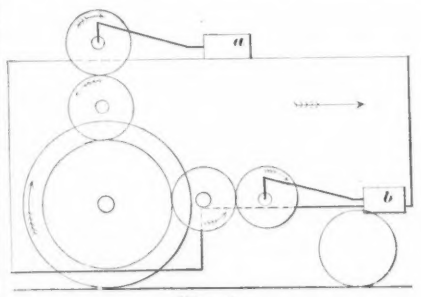


Fig. 1.

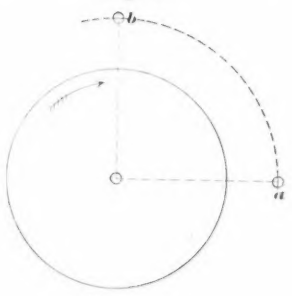


Fig. 2.

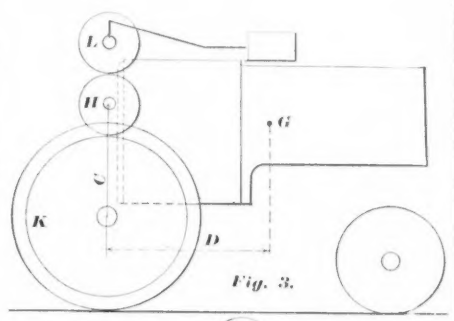


Fig. 3.

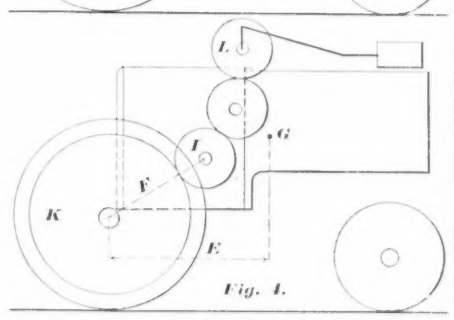


Fig. 4.

THAT TRACTION ENGINE.

Now this moment is equal to the product of the force of gravity into its arm *D* or *E*, that is, the horizontal distance from the center of the driving axle to the vertical line drawn through the center of gravity *G*. If this arm is 3 feet, the weight of the engine will have to be $\frac{2{,}500}{3} = 833.33$ pounds, friction being neglected.

Now in regard to the last point to which our correspondent refers, we only need to say that by the term, "distance from the center of driving axle to the center of gravity," we simply meant the horizontal distance *D* or *E* from the center of axle to the vertical line drawn through the center of gravity, and not the distance measured direct between these two points, as our correspondent understands it to be. We acknowledge that the term is ambiguous, but we have heard it used so often during many years of locomotive practice that we did not notice the ambiguity when we answered the question. Anyhow, we believe that it could not have led any one astray in computing the weight required to overcome the lifting power. J. G. A. M.]

Some Suggestions.

Editor American Machinist:

I would suggest to your correspondent "Novice," that in setting a cylinder on a feeding carriage to bore, it is a good plan to put a tram wire in the tool hole of the boring bar, to reach over the flange and true by the outside of the cylinder, moving the carriage to true the other end.

In setting for a feeding bar it will do to tram from each end of the bar.

A little thought will show Novice that either plan will insure uniformity in the thickness of the cylinder wall after finishing, which might not be the case with different setting, owing to the lathe centers being out of line.

Do not reverse the plans, but take the one fitting the bar you used. With these plans, the lathe centers could be badly out of line without vitiating the final result.

To G. W. B. (77) I would say, before driving in the pin for a shrink fit, drill a small hole through the side of the bar to let out the air as the pin goes in, and having inserted the pin, pour water on the outer end of the pin, until the bar is cooled off.

The trouble lies in the fact that the bar heats and expands the pin, and that keeps the bar wide open until the outer shell of the bar is somewhat cooled and set, and the bar then shrinks from the center towards the outside, the pin doing the last shrinking loosens itself, notwithstanding a liberal allowance for shrink.

I was taught this lesson while an apprentice in this fashion: I was given a laborer and ordered to remove a wrought-iron crank from an old steamboat shaft, and was told to build a fire under it, warm it up, and it would come off easily. We let the job soak in the fire while we told a story or two, and the whole business had got pretty hot. We hauled away the fire, and did our best with a big sledge to drive off the crank, but it was no go. We gave it up, and went home. Next morning the crank was "shaking loose," and slid off easily.

BENJ. F. WILSON.

A Large Pump.

Editor American Machinist:

In reply to X., on the largest pumping engine in the world, he will find a larger engine at Murton Colliery Company, Durham, England. Diameter of cylinder, 110 inches and 14 feet stroke, pumping from a depth of 250 fathoms, or 1,500 feet.

When the shafts were sunk in 1838, at a depth of 90 fathoms, or 540 feet, they had 27 pumps in shafts, and engine representing 1,584 horse-power, and driven by 39 boilers; finished sinking in 1843; depth, 250 fathoms, and cost £400,000.

As for X.'s nut, I think he will find larger nuts in the world, and I am sure, instead of 20 men, 6 men would be sufficient to take it off and put it on, and I think he will find in Wales or Cornwall, pumping engines' nuts as large as the one he writes about. The oscillating engine on the (Ireland) mail boat, between Holyhead and Kingston, has a cylinder 110 inches diameter and 72 inches stroke of piston.

Hoping I have not trespassed too much on your space. X. X.

[There seems to be a discrepancy somewhere; in the above, the cylinder is 110 inches diameter, and piston stroke 14 feet, and the engine is rated at 1,584 horse-power. Our correspondent X., in our issue of January 29, gives a cylinder diameter of 110 inches, stroke 10 feet, and rates the engine at 5,000 horse-power.]

About Files.

Editor American Machinist:

Referring to Mr. C. W. Crawford's remarks about files, I have worked in shops in different parts of the country, and have only found one place where we were sure of getting good files. That was at the Dickson Manufacturing Company's, at Scranton. They used English files, and I can safely say one of them would outlast three of the files I am now using; still it is thought we have good files.

I have had files break in my hand in using, and have a mark on my wrist from such breaking. I think it would pay our file makers to do better. We can make other things as well as they are made anywhere, and why not files?

JNO. C. HURST,
Kingsland Shops, D., L. & W. R. R. Co.

[Our experience with files is that they can be had both of good and poor quality. American files of good quality will cost more than those made from inferior steel, which may have a good deal to do with the matter. If we remember rightly, American files tested at the Philadelphia Centennial held their own against all others.]

Boring a Deep Hole.

Editor American Machinist:

Your edition of February 12 contains an article entitled, "Boring a Small, Deep Hole," in which the writer says: "I do not know that this would work on a lathe, as perhaps the chips would work under the set-screw and disturb the position of the tool." If the tool be inverted, we will have one set-screw on top and one in front, leaving the bottom of the hole free for the chips.

E. L. MUELLER, JR.

New Ideas in Palestine.

The railroad and the electric light have invaded Judea, and the awed Mohammedan gazes upon the unwonted spectacle and cries "Mashallah"—"God is great!" and goes on his way wondering. Jerusalem is already lighted by electricity. The plant is placed in a flour mill close to the Damascus gate, by which St. Paul escaped from his persecutions, and adjoining Mount Calvary. Work is being pushed on the railroad from Jaffa to Jerusalem, and when it is completed, and the locomotive's whistle is heard in the valley of Jordan, extensions of the line will be made from Dan to Beersheba. These improvements naturally attract increasing numbers of pilgrims, and one great caravan of visitors recently entered the Holy City with a band of music at their head.—*Sunday Mercury.*

A Correction.

In our description of Prof. Sweet's traveling crane we stated the span as 15 feet. It should have been 30 feet. The mistake arose from the fact that there were four views of the bridge on the same sheet, two of them drawn to a scale twice as large as the other two, and, no dimension figures being given, the larger scale was, in measuring, accidentally taken for all views.

The question of increasing the capacities of the Erie and Champlain canals is again before the New York State Assembly, in the way of a bill to appropriate five hundred thousand dollars for enlarging the locks. The bill ought to become a law without serious delay. The efforts of European countries to utilize natural and artificial waterways ought to be a lesson to this country. Cheap freights are no less important to the inhabitants of large cities than to the farmers of the country, and whether cheap freights shall come by keeping down railroad freights or by actual use of the canals does not make much difference.

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Southern Iron Production.

There are numerous indications that the iron-producing interests of Pennsylvania and Ohio are beginning to feel quite strongly the effects of southern competition in the production of pig-iron, and it is said that the recent shut down of furnaces in the Mahoning and Shenango valleys, though attributed by the iron men to excessive freight rates, and the high price of coke, is really due to the fact that iron is being sold by southern furnaces at rates which cannot be met by their northern competitors, and it is hoped that the curtailing of supplies will raise prices.

The cheaper southern iron is by some attributed to the cheaper labor in the South, but we should not expect any permanent advantage from this factor. The most important circumstance, we take it, is the close proximity of coal and iron found in the South. Owing to this, the amount of labor required to bring them together and make pig-iron, is of course much less than where either material has to be hauled long distances. It will be found in the end that that portion of the country in which least labor is required for the production of iron will furnish it for our manufacturers, or at least fix its price, and there can be no doubt that, the interests of all considered, it is best that this should be so. The interests of American manufacturers, of course, lie in the direction of cheap iron and other materials to which they can apply their labor for the production of machinery and other useful articles. The region from which these materials come with the least expenditure of labor is naturally, and therefore properly, the place to obtain them, and as an industrial community we shall be best off when things have been adjusted in conformity to this principle. If anything will maintain the supremacy of northern iron producers it will be the higher wages paid by them, for which they will inevitably secure the more efficient labor. If this fails, then the iron for our manufactures must come mainly from the South, and naturally the highest rates of wages will eventually be paid there.

Since the above was written, a Washington press dispatch announces that Labor Commissioner Wright's report on the cost of production of steel and steel rails has been transmitted to Congress by the President. Not having access to the report itself, as yet, it is somewhat unsafe to attempt to arrive at conclusions drawn from it, but according to the dispatch, this country is divided in making the report into two districts, the northern and southern, and comparing the figures given for the two districts, it is seen that the advantage of the South in the production of pig-iron is due almost entirely to difference in the cost of materials out of which it is made, and that, while the day rate of labor may vary considerably, the labor cost per ton of iron does not vary to amount to anything between the sections; the average cost of labor per ton of iron, taking 26 northern establishments, being $2.204, while the average cost of labor per ton, taking 24 southern establishments, was $2.341, showing a difference in favor of the South of something less than fourteen cents, which is more than overbalanced by the greater amount of iron obtained per ton from northern ore, thus showing that the so-called cheap labor of the South is cheap only when the rate paid per day is considered, not when the labor cost of what is produced is the basis of computation. This, of course, is not surprising, because similar results have been found by comparison of so-called cheap with high-priced labor the world over, and it has been demonstrated that, other things being equal, the highest priced labor produces the lowest cost goods.

A Mystery.

The New York *Times*, of February 22d, contained a copy of the resolution printed below, which was announced to have been passed by the "New York State Engineers Society" at a meeting held in this city at 305 West Thirty-fifth street. The resolution is as follows:

We do not find that the employes of the Central road have asked for the passage of such a bill. We believe that where compensation is guaranteed and certain, as is the case with steam surface railroads, the matter of time at which such compensation should be paid is best left between employer and employe. The bill, if it becomes a law, would increase the company's expenses $50,000 per year, and to no purpose except for the benefit of the rumseller, the gambler, and the pool room proprietor. If the bill passes, the company, which now employs 5,000 unskilled laborers at rates from $1.75 to $2.25 per day, will let this class of work out by contract. The contractor will have to have his profit out of these wages, and he may or may not pay his men what they then earn. No corporation treats its employes better than the New York Central, and we believe from long experience that monthly payments are more to the comfort of its men than weekly ones.

It is further announced by the *Times* that copies of this resolution were sent to the members of the Judiciary Committee of the New York Assembly, before whom a bill is pending, making it mandatory upon railroads to pay all employes weekly instead of monthly, as at present. And it was further announced that the society believed the proposed law was aimed especially at the present management of the New York Central road; which we presume accounts for that road being specially mentioned in the resolutions, notwithstanding the fact that such a law, if passed, would, of course, apply to all the roads of the State alike.

It will be noticed that the resolution is rather a peculiar one to be passed by an organization of engineers, and it aroused our curiosity. It was at once evident upon the face of it that no society of stationary or locomotive engineers of any standing would pass such resolutions, and it was equally hard to believe that any reputable society of civil or mechanical engineers would meddle in such a matter, so entirely foreign to engineering questions, or if it did so meddle that it would go out of its way to thus wantonly insult and grossly misrepresent a worthy body of citizens. Nor did it seem probable that the New York Central company would inspire any irresponsible persons to get together and pass such a resolution, for it would be tantamount to a confession that the road employs just the kind of men that its officers claim not to employ, *i. e.*, men who are utterly untrustworthy, and in whose hands the placing of the lives of its patrons would be little less than criminal.

Inquiry at the office of the *Times* developed the fact that nothing was known there of such an organization, and all that was known was that the resolution, with the accompanying comments, were sent in to the paper under the seal of the mythical society, and with the name of Arthur P. Braxton as secretary. Diligent inquiry at 305 West Thirty-fifth street failed to unearth any such society, or any one who knew of the existence of such a society, and up to this time we have been unable to find any trace of Arthur P. Braxton. Quite a number of engineers, civil and mechanical, some of them connected with engineering journals, and others connected with the New York Central road, were asked if they knew of any such society, and all replied in the negative, and expressed doubts as to the existence of any such society. Yet here is what purports to be a society of engineers, which is apparently attempting to influence public opinion and legislation, and incidentally to injure the good name and reputation of a body of citizens in every way entitled to respect. Who and what is the New York State Engineers Society? Did it ever take any other official action besides the passing of this resolution? or did it ever exist for any other purpose? And if there is such a society of engineers, why should it desire to meddle with a matter which would appear to be none of its business, and place itself on record as holding the opinion that the employes of the New York Central road cannot be trusted with their own money, because, if they are, it will result in no good except to the rumseller, the gambler and the pool room proprietor?

Literary Notes.

Vol. XI of *The Locomotive*, published by the Hartford Steam Boiler Inspection and Insurance Co., Hartford, Conn., has just been issued. It contains the monthly issues published during 1890. It deals with the care, management and inspection of steam boilers, and, like its predecessors, contains much valuable information and interesting reading. Price of the volume, $1.

John Wiley.

John Wiley, the head of the publishing house of John Wiley & Sons, New York, died recently at his home in East Orange, N. J. He was born in 1808, and, when seventeen years of age, entered the publishing house of Wiley, Lane & Co., of New York, of which he later became a member, and finally the head of the firm first mentioned, which is well known all over the country as publishers of industrial and technical works. Mr. Wiley was a quiet, unobtruding man, man, rising in the world, from the start, by force of honesty, strict attention to business, and natural talent.

Joshua L. Pusey.

Joshua L. Pusey, who died last month at Wilmington, Delaware, was president of the Pusey & Jones Co., of that city, a firm known the world over. He was born in 1820, and began his apprenticeship at the machinists' trade in 1836, when sixteen years of age, with Betts, Pusey & Harlan, afterward remaining with the firm as journeyman and foreman, until 1848, when, with Mr. Jones, he established the firm of Pusey & Jones, now the Pusey & Jones Co. Mr. Pusey is spoken of on all sides as a man of sterling integrity, and one of Wilmington's most prominent business men. In referring to him, the Wilmington *Morning News* says:

"Thousands of people have been personally benefited by his business tact and ability, and hundreds of skilled mechanics who have gone out from the works over which he presided will gratefully remember the quiet, kindly man, who seemed to have a personal interest in every workman employed in the works."

Mr. Pusey had been in poor health for some years; his last visit to the works for which he had done so much was made about six weeks before his death.

Personal.

Mr. Peter Shellenback, of Richmond, Ind., who has occasionally contributed to our columns, and who for some time past has been at the head of a shop in which his patent pulley lathe is manufactured, will, in a short time, take hold of the commercial side of the machine business by going upon the road with a line of machine tools. His friends at the Niles Tool Works, and other places where he has held positions of responsibility, will, of course, wish him success in his new field.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(101) P. P., Brooklyn, N. Y., writes: Please give me the horse-power of an engine with cylinder 3½ inches diameter; stroke of piston, 3½ inches; number of revolutions, 250 per minute; boiler pressure, 50 pounds. *A.*—We should rate the engine at one indicated horse-power.

(102) C. R. F., Croton Landing, N. Y., asks: How many square feet of surface will be required in a keel condenser for a 3x4-inch cylinder engine? *A.*—The cooling surface of a condenser depends on the horse-power of the engine, terminal pressure, and

temperature of the sea water. Ordinarily, keel condensers with 10 square feet of cooling surface per indicated horse-power will give good results.

(103) K. G. S., Muncie, Ind., writes: Where can I obtain any information as to the process of making malleable iron castings? Is there anything published on the subject? *A.*—See Materials of Engineering, Part II, by Prof. R. H. Thurston; also see answer to Question 281, in our issue of July 17, 1890.

(104) Reader, Corry, Pa., writes: I want to build a pair of engines with link motion, cylinders 10 inches diameter, 9 inches stroke, number of revolutions about 250 per minute. What size of ports and dimensions of valve would you advise? Engines are to be designed for hard work. *A.*—Steam ports $\frac{3}{4}$ inch wide by 7 inches long; exhaust ports, $1\frac{1}{2}$ inches wide and 7 inches long; bridges, $\frac{3}{4}$ inch wide; lap of valve, $\frac{3}{4}$ inch.

(105) W. F. D., Waterbury, Conn., writes: Please inform me if there are spring motors manufactured which will run a machine requiring about as much power as a sewing machine. *A.*—We do not know of any motors manufactured of so large a size. 2. Where can I get large springs for such a machine? *A.*—Write to any first-class spring manufacturer. You will have no difficulty of obtaining any kind of spring needed.

(106) E. M., Detroit, Mich., writes: Kindly answer the following questions: 1. Will a good marine governor be readily taken up? *A.*—We believe it will. 2. What are the deficiencies in the present marine governor? *A.*—In a general way it may be said that such governors are not as reliable as they should be. 3. What in your opinion are the essential points for a successful marine governor? *A.*—Trustworthiness in all kinds of weather, and simplicity.

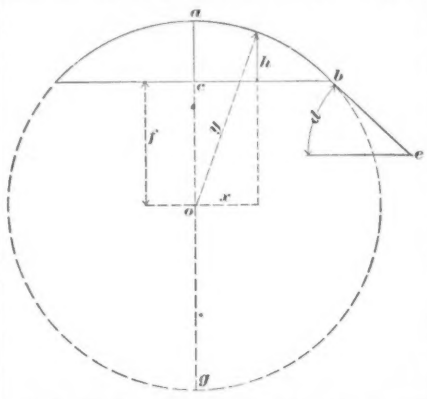
(107) B. P. E., Lawrence, Mass., writes: Please give me through your columns the dimensions of a single engine, and also of a compound engine for a tugboat 53 feet long, 11 feet wide, and 4 feet draught, well designed. *A.*—High-pressure non-condensing engine, diameter of cylinder 12 inches, stroke of piston 14 inches. Compound surface condensing engine, diameter of high pressure cylinder 9 inches, low-pressure cylinder 18 inches diameter; 12 inches stroke.

(108) J. S. L., New York, asks: What is needed to make jet propulsion a success? *A.*—Some new law in mechanics which will prove other established laws to be incorrect. We have no faith in jet propulsion for ordinary purposes. 2. Is it better to use a steam pump than a centrifugal pump? *A.*—If you are determined to try the experiment, we suppose you will have to use a steam pump. 3. With a 16 horse-power steam pump, and a boat 40 feet in length, what size nozzle is practical to attain a speed of 10 miles an hour? *A.*—We do not know. 4. I want a good work on the subject; can you recommend one? *A.*—We do not know of any books treating on this subject.

(109) B. I., Binghamton, N. Y., asks what kind of material patent grist-mill rolls are made of, and how they are recut, whether annealed or not, and if not, then what kind of a tool is used? *A.*—They are usually made of chilled iron, and are usually cut on a special machine built for the purpose, which machine resembles a planer in its general construction, but has centers mounted on the bed, to support the roll, which is turned by a special mechanism to give the spiral. The tools resemble chasers, and have a number of teeth, and the cutting speed is very slow. The rolls are not annealed. You will find the process more fully described in our "Shop Notes," issue of August 11, 1888.

(110) S. F., New York, writes: Please inform me through your paper as to the salaries paid draftsmen of different degrees of experience, and also of the duties required of them. *A.*—There are no stated salaries paid to draftsmen. Many are paid by the day, some by the hour, and a few have yearly salaries. The amounts paid depend on the ability and energy of the draftsmen, the importance of the position, and the employer's appreciation of a draftsman's services. They vary from $2 per day to $3,000 per year, and sometimes more. The duty of a draftsman also varies. Sometimes he has simply to make drawings from sketches, and frequently he has to design and make all computations in connection with it.

(111) M. F. H., Astor, Fla., writes: Kindly inform me if the series of articles on Modern Locomotive Construction, published in the AMERICAN MACHINIST, give any information in regard to setting locomotive valves and lining up crossheads. I am much in need of a work of this kind. I am running an engine where I have to do my own repairs. If you know of such a work you will greatly oblige one of your readers by naming it. *A.*—A practical example of setting the valve of a locomotive in the erecting shop is given in the articles to which you refer. See our issue of April 30, May 14 and May 28, 1887. In these articles nothing is said relating to lining up crossheads. Probably Locomotive Engine Running and Management, by Angus Sinclair, may help you.



(112) H. H., West Troy, N. Y., writes: Kindly give the solution of the following problem: The height $a\ c$, half the chord $c\ b$ of an arc being given, and the angle d of the tangent to the curve being given, it is required to form an equation for finding any ordinate, as h of the curve. *A.*—When the height and half the chord of the curve is given, it is not necessary to pay any attention to the angle d. The first step will be to find $c\ g$, which is found by dividing the square of $c\ b$ by $a\ c$; then adding $c\ g$ to $a\ c$, we have the diameter of the circle, and half of this is the radius y. Subtracting $a\ c$ from y we obtain f. Let x be the distance from c to any ordinate, as h, then we have

$$h = \sqrt{y^2 - x^2} - f.$$

(113) H. T. S., New Orleans, La., writes: I have been running an irrigating pump, which has an 18-inch suction, and 15-inch discharge, with an engine 12x24 inches, running at a speed of 95 to 100 revolutions per minute, steam pressure of 90 pounds. What I find strange in running the pump is, when the river is high, giving about 5 feet lift only, the engine will strain and thump, and it will be difficult to keep steam. On the other hand, when the river is low, so that the pump will have to lift about 18 feet, the engine will run smooth and use less steam. Please explain the cause, if possible. *A.*—We cannot locate the trouble without knowing more of the pump and engine. It may be that the valves of the pump are not suitable for work, retarding the discharge; it may also be due to a faulty construction of the engine.

(114) J. M. R., ———, asks: How are holes in hardened steel lapped out after hardening? *A.*—There are various ways of doing this, and the method adopted must depend, to some extent, upon the character of the work to be done. One good way is described by Mr. T. R. Almond, in our issue of February 27, 1890. In some cases, however, it is not admissible to have any elasticity in the lap, and especially is this the case where the most accurate possible work is to be done. Copper or lead is sometimes used in such cases, or a bush of cast-iron having a taper hole through it which fits a taper arbor. The bush is then split open at one side, so that, by driving it further up on the arbor, it is expanded as the lapping proceeds. With such a lap, oil and flour of emery are used. Your other question cannot be answered within the limits of this column, as it would require illustrations. We expect, however, to publish an illustrated article on that subject before long.

(115) A. D. A., Groton, N. Y., asks: What must be the boiler pressure to obtain 90 pounds at the engine, the boiler being 450 feet away from engine, and the pipe is covered in the best manner possible? Is the scheme practical, and if not, why? Is the ratio of decrease in pounds per inch for every 10-foot section the same, and how much is it? *A.*—The experimental data on the loss of pressure of steam flowing through pipes is not very satisfactory for a guide in computation, but it is reasonable to assume that the loss due to friction depends directly upon the length of the pipe; that is, for double or half the length, the loss will be twice or one-half as much. If the diameter be changed, the loss will be inversely proportional; that is, if the pipe be doubled in size, the loss will be one-half as much. Lastly, the loss will be as the square of the velocity; that is, if the velocity be doubled or trebled, the losses will be four times or nine times as much. From the foregoing, it will be seen that in order to answer your question we must know the diameter of the steam pipe, and the quantity of steam used. It is practical to place the boiler 450 feet away from the engine, but it is not good practice if it can be avoided.

(116) C. A. C., Richmond, Me., writes: I would like a little advice from you in regard to my welfare. To begin with, I am 18 years of age, and, if I am not in error, it is about the right age to start. I have always taken a fancy to engine running and machinery since I was old enough to understand anything. I have a common school education, and I am continually improving myself by reading works on the steam engine and kindred subjects. I am now making a small model of a locomotive. I applied at a locomotive works and a railroad repair shop for an apprenticeship, but failed in both places. I would like to learn how to run a lathe, and I have a great desire to invent something, but do not know what. Now I would like a little advice from you which will benefit me. *A.*—Do not try to invent anything until you have become a mechanic. Do not waste your time in making models of locomotives, but persevere in your search for an apprenticeship. It is not necessary to start in a railroad shop, you can learn the machinist trade in any other first-class machine shop; we should prefer a small shop in which all kinds of repairs are made. Persevere in your studies; see our issue of February 19. After you have had experience, and then still prefer locomotive building, watch for an opening, and make good use of all your opportunities. 2. Do you think that the locomotive will, in the near future, be superseded by electric motors? *A.*—We do not know. 3. Would not a locomotive hold its own by a more economical use of its dead weight? *A.*—The weight of a locomotive is now used to the best advantage. 4. Could they be run with the Corliss valve gear and be more economical? *A.*—There are practical objections to the application of this gear to a locomotive. 5. Do you think a speed indicator, to indicate between 5 and 100 miles per hour, would be adopted by railroad companies? *A.*—There are speed indicators made, which can be used whenever it is deemed necessary to do so.

(117) C. B. K., Athens, Pa., writes: Please give me a description of the two processes of printing from tracings on linen; and state how the sensitive paper should be prepared for a blue ground and white lines; and white ground with dark lines; also the kind of paper to use. *A.*—Procure an ordinary picture frame and glass; into the frame fit the back or wooden board about $\frac{1}{2}$ of an inch thick, cover one side of this board with three thicknesses of flannel, and on the rear of the frame screw loosely four buttons so that the back or wooden board can be kept in the frame. Dissolve 2 ounces of citrate of iron and ammonia in $8\frac{1}{2}$ ounces of water; also dissolve $1\frac{1}{8}$ ounces of red prussiate of potash in $8\frac{1}{2}$ ounces of water; when the two are dissolved mix them in a dark bottle and keep it in a dark place for future use. Procure sheets of paper somewhat smaller than the inside of the frame. The paper should have a hard surface, so that the liquid cannot easily soak into it. Coat this paper with the solution previously prepared; to do this, use a sponge dipped into the solution and then draw the sponge lengthwise and crosswise on the paper so that the paper will receive an even coating, and hang it in a dark room or closet to dry; when dry, keep the paper in a dark place. When a blue print is to be taken, place the tracing in the frame with its face on the glass, on the tracing place the paper with its coated face on the tracing; on this paper place the board with the flannel in contact with the paper, and fasten the board into position by means of the buttons attached to the frame. Expose the tracing to a strong sunlight for about $3\frac{1}{2}$ to 4 minutes, then take the paper out of the frame and place it in a tub of water and let it remain there for about five minutes; after this, take it out and let it dry, and thereby finishing the blue print. In connection with this see AMERICAN MACHINIST, page 1, January 29, 1887. All processes for obtaining dark lines on white ground are not so simple, and some of them are not suitable for every-day use. Those that are of any practical value are either patented or kept secret.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant's (1891) gear catalogue ready. See adv. p. 20.

Link-Belting and Sprocket Wheels.

Send for Catalogue of Link-Belting.

Over 50,000,000 feet of Link-Belt in use.

Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

The Improved Justice Hammer. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

For a knowledge of blue printing write to D. R. Miller, architect, Harrisburg, Pa.

Ice and Refrigerating Machines, 155 sold, and all successful. David Boyle, 521 Monroe St., Chicago, Ill.

"How to Keep Boilers Clean." A 96-page book mailed free by Jas. E. Hotchkiss, 120 Liberty st., N. Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N. Y.

Milling Machines. Pedrick & Ayer, Philadelphia, Pa.

Universal Grinding Machine. Pedrick & Ayer, Philadelphia, Pa.

Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

Get particulars of our new Wall, Suspended and Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

I. D. L. Drawing Stands. The original. For particulars and prices, address W. S. Rogers, Troy, N. Y.

One Star Hack Saw will cut steel a whole day without filing.

Castings for small and medium-sized vertical engines. Humphrey's Foundry, Bellefontaine, Ohio.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

Send $1 for Catalogue D, Fine Tools and Supplies. Over 550 pages. Fully illust'd. Free when $10 worth goods are ordered. Frasse & Co., 92 Park Row, N. Y.

Audubon Machine Works, New Haven, Conn. Electrical work, superior facilities, builders of machinery, heavy and light.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal St., Chicago, Western Agent.

For best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves, T. Kieley, 11 W. 13th st., N. Y. Send for des'n

Billings & Spencer Co.'s Packer & Boiler Ratchet, and all kinds of Forged Wrenches. S. A. Smith, 23 S. Canal St., Chicago, Western representative.

For the latest improved Eccentric Hook, Connecting Rods and Stub Ends, address T. C. Dill Machine Company, Philadelphia, Pa.

Self-adjusting Hand-screw for pattern makers, cabinet makers and wood workers generally; send for circular. Wm. H. Denney, Lancaster, Pa.

25" / 32" / 37" / 42" — "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

DuBois & DuBois, Patent Attys, 715 11th St., Washington, D. C., procure first-class patents. Send stamp for illustrated pamphlet, "March of Invention," containing valuable information, and list of references.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

Hawkins' Calculations, for engineers, firemen and machinists. Send 25 cents for Part I, and subscription blank for whole issue, 10 parts (bound vol. $2.50). Theo. Audel & Co., 91 Liberty St., office 3.

Every draftsman needs one. The Engineer's Sketch Book of mechanical movements, appliances, devices, contrivances, etc., by T. W. Barber. 1,936 illustrations, 8vo. cloth, $3. Catalogue of books on mech. subjects free. E. & F. N. Spon, 12 Cortlandt St., New York

De Lamater Screw Propeller Wheel made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Club Rates.—If no one is getting up a club for the AMERICAN MACHINIST in your town or establishment, send for Circular of New Club Rates, and try it yourself. Address AMERICAN MACHINIST, 96 Fulton St., New York.

"Binders" for the American Machinist. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 53 East 10th St., New York.

MANUFACTURES.

A machine shop will be established at Ocala, Fla.

A rolling-mill plant will be established at Jasper, Ala.

Another ice factory will, it is stated, be erected at Athens, Ga.

The erection of a cotton factory is talked of at Talladega, Ala.

A flouring-mill is to be erected at Houston, Tex., at a cost of $20,000.

The Wilmington (N. C.) Cotton-mills will put in additional machinery.

Little Rock, Ark., will put additional machinery in its electric light plant.

The Orion Knitting-mills, at Kinston, N. C., will put in additional machinery.

A stock company is being organized to erect an ice factory at West Point, Va.

Fraisse & Blum will, it is reported, establish an $8,000 ice factory at Houma, La.

James E. Worswick contemplates the erection of a cotton-mill at Montgomery, Ala.

J. W. Bookwalter will build boiler works at Springfield, O., to employ 400 men.

There is some probability that a steel plant will be established at Clarksville, Tenn.

Johnson & Co., Manchester, Va., are reported to be building a new iron works plant.

The Duluth (Minn.) Steel Works are to be immediately enlarged, at a cost of $300,000.

E. M. Cross, of Berlin, N. H., is building a foundry in connection with his machine shop.

J. D. McNeil & Company contemplate the erection of an ice factory at Fayetteville, N. C.

Mr. Schwab is reported as to erect a $10,000 cotton gin and grist-mill at Yoakum, Tex.

San Antonio, Tex., has appointed a committee to raise $60,000 stock for a new rolling-mill.

The Viaduct Construction Company will establish bridge works at Max Meadows, Va.

Samuel Kaye will, it is reported, put new machinery in his ice factory at Yazoo City, Miss.

Northern parties are reported as to remove a large nut and bolt factory to Ft. Payne, Ala.

The organization of a stock company at Laurens, S. C., for the manufacture of ice, is talked of.

The Smith-Hill Company (Quincy, Ill.,) will build an addition to their extensive machine shops.

A stock company is reported as being organized, to erect another cotton-mill at Hickory, N. C.

Nelson Tift is corresponding with parties relative to the establishment of car works in Tifton, Ga.

It is reported that additional machinery will be put in the Altamaha cotton-mill at Burlington, N. C.

The Watts Steel and Iron Syndicate is erecting a foundry and machine shop at Middlesborough, Ky.

The Lead Hill Foundry and Machine Shops (Lead Hill, Ark.,) will, it is reported, put in new machinery.

Efforts are being made for the organization of a stock company to erect a cotton-mill at Lowell, N. C.

J. C. Shaw, of Collins, Ohio, is investigating with a view of removing his pump works to Clarksville, Tenn.

The Dayton Steel Chain Company, of Dayton, O., has been incorporated, with a capital stock of $15,000.

The capacity of the Calumet Cotton Factory, Mammoth Springs, Ark., will, it is reported, be doubled.

The Jenifer Iron Company will, it is stated, make extensive improvements to its iron furnace at Jenifer, Ala.

A $100,000 cotton factory is reported as to be erected at Cheraw, S. C. H. L. Souchlin is interested.

George Baring and Oscar White are erecting and will operate an iron foundry and nail factory at St. John, N. B.

The Long Island Cotton-mills Company, at Monbo, N. C., is to put an electric light plant in its cotton-mill.

The Michigan Railway Supply Company have commenced the erection of a large factory at Detroit, Mich.

J. M. McCreary is reported as to erect an iron foundry and machine shop at Senoia, in Coweta County, Ga.

Towne & Co. contemplate the erection of a $60,000 ice factory and cold storage warehouse at Kissimmee, Fla.

Steel car works, to turn out from fifteen to twenty cars per day, are to be built near Des Moines, Iowa.

The Brush Electric Light and Power Company will put new machinery in its electric light plant at Columbus, Ga.

The Norfolk & Western Railroad Co. (office, Roanoke, Va.,) will, it is stated, erect repair shops at Hagerstown, Md.

A stock company will be organized to operate the Murray & Stevenson iron foundry and machine shops at Anniston, Ala.

The Bloomsburg Car Company, of Bloomsburg, Pa., is investigating with a view of establishing car works in Bristol, Tenn.

The McArthur & Gilmore Foundry Company, of Cleveland, Ohio, has increased the capital stock from $10,000 to $30,000.

The Bohlen-Huse Ice Company is reported as to establish a new ice factory in South Hampton, Tenn., at a cost of $85,000.

W. H. Phillips, of Taunton, Mass., will, it is reported, probably remove his foundry and machine shops to Middlesboro, Ky.

Work on the new factory of the South Wareham (Mass.) Nail Works is being pushed rapidly forward. New machines are to be put in.

The Harrisburg (Pa.) Car Manufacturing Company's plant has been purchased by local capitalists, who will put it in operation.

Two large companies for glass manufacturing purposes, the Dames and the United States, have been chartered in Pittsburgh, Pa.

It is stated that the Reading Iron Works, of Reading, Pa., is investigating with a view of establishing iron works in Fort Worth, Texas.

The Hazen Company, of Anderson, Ind., is now erecting an immense nail plant, and contemplates the erecting of a steel billet plant.

The new Boston Iron and Steel Works plant, now building at McKeesport, Pa., is nearing completion. Three hundred hands will be employed.

The new Boston Iron and Steel Works plant now building at McKeesport, Pa., is nearing completion. Three hundred hands will be employed.

W. C. Hargrove is endeavoring to organize a stock company for the purpose of erecting a cotton and woolen mill at Sulphur Springs, Tex.

Charles F. Alverson, Nunda, N. Y., writes us: I have purchased the foundry and machine shop here, and will take possession next month.

The Spiral Metal Tube Company, of East Orange, N. J., is investigating, with a view to establish branch tube works in Chattanooga, Tenn.

The Salem Iron Works (Salem, N. C.,) propose organizing a stock company for the purpose of manufacturing engines on a more extensive scale.

The Stowell Iron Company, Duluth, Minn., has filed articles of incorporation, with a capital stock of $1,000,000, divided into shares of $10 each.

The Seaton Manufacturing Company, of Cleveland, Ohio, is corresponding with a view of removing its bolt and nut factory to Anniston, Ala.

Charles Tyler, of Baltimore, Md., has purchased, it is reported, and will operate the "Hope" foundry and machine shop at Fredericksburg, Va.

A proposition has been made for the organization of a $350,000 stock company for the purpose of establishing a hardware factory at Roanoke, Va.

The Pullman shops at St. Louis, recently burned, are to be rebuilt. A force of men is now clearing the ground, preparatory to the work of rebuilding.

E. J. Lowenstein, representing New York parties, is investigating, with a view of organizing a $100,000 stock company, to erect a silk-mill in Hagerstown, Md.

The Southern Rolling-mill will, it is reported, increase its capacity by the erection of ten additional puddling furnaces at its rolling-mill near Avondale, Ala.

The plant now being erected by the Bluffton Car Wheel Works, at Bluffton, Ala., will have a capacity of 200 wheels per day, and will employ about fifty men.

William Caldwell has purchased half a block of land at Twenty-third and Arch streets, Philadelphia, on which he will erect a five-story machine shop.

The stockholders of the Oswego Foundry and Malleable Works (Oswego, N. Y.,) have decided to increase the capital stock, and put in a malleable plant.

A rolling mill will probably be started at San Antonio, Tex., by Adams & Mariott, who ask $55,000 stock subscription, which will probably be raised.

Michigan parties are corresponding relative to the removal of their agricultural implement works to Clarksville, Ky. The Board of Trade will give particulars

The Clementsport Iron Company, of Nova Scotia, is applying to the Dominion Parliament for an act of incorporation, with power to erect smelting works, etc.

The Paragon Manufacturing Company, of Columbus, Ga., will probably increase its capital to $100,000, for the purpose of doubling the capacity of its cotton-mill.

The Chicago (Ill.) Foundry Supply Manufacturing Company is about to construct a facing-mill at Eighteenth and Rockwell streets, 300x70 feet, to cost $50,000.

R. J. May has sold his foundry and machine shop at McKeesport, Pa., and has purchased another site on which he will erect a much larger plant to cost about $50,000.

The Illinois Hardware Company, of Litchfield, Ill., has been incorporated, with a capital stock of $10,000. Messrs. Updike, Cratty and Bartlett are the incorporators.

The Thomas & Pettengill Knitting-mill located at Amsterdam, N. Y., will soon be started up with a full force. More than a hundred hands will be given employment.

The Chesapeake & Ohio Railroad Company (office, Richmond, Va.,) is reported as having secured site, and as to erect a $250,000 foundry and machine shops at Russell, Ky.

The managers of the Ames Manufacturing Company, Chicopee, Mass., expect to employ several hundred more men at their shops this season than for a number of years.

The new building erected for the National Pipe Bending Company (New Haven, Conn.,) has been completed, and the machinery will be in running order about March 1st.

William P. Kingsley writes us that he will not start a foundry at Hammond, Ind., as reported. He made the citizens a proposition to that effect, which was not accepted.

Mr. J. H. Crawford, whose address is Commercial Hotel, Oil City, Pa., is desirous of hearing of a place somewhere west where he can, with fair prospects, start a small boiler shop.

It is stated that efforts are being made at New Castle, Va., looking to the organization of a company for the establishment of edge-tool works. A. E. Humphreys is interested.

The pipe works at Bessemer, Ala., are expected to start up about the 1st of March. They will employ about 800 hands to start with, and this number will be speedily increased to 1,000.

The Buffalo Steam Pump Company (Buffalo, N. Y.,) are opening warerooms and a branch office at 76 John street, New York, where they will carry a stock of pumps of all styles and sizes.

Negotiations are pending between parties at Corsicana, Texas, and an Eastern syndicate for the establishment of a stove foundry and machine works in that city which are to cost $150,000.

The C. P. McWayne Plow and Machine Company, of Wytheville, Va., will move to Graham, Va., and operate under the title of the Foundry and Machine Company, with a capital stock of $30,000.

Ohio capitalists are investigating with a view of organizing a stock company to establish iron works and a rolling-mill in Florence, Ala. The Ohio Development Company can give information.

A contract has, it is reported, been signed by Chicago (Ill.) and other capitalists for the erection of a $200,000 structural and galvanized iron works, in Pulaski City, Va. L. J. Hyland is interested.

Jenkins & Lingle, Bellefonte, Ohio, write us that they are selling the Jenkins improved power hammers faster than they can make them. They send us a list of recent sales which looks like business.

The Chicago & Erie Co. will erect, at Huntington, Ind., a building 250 feet long, by 75 feet wide, in which to do car repairing. This will increase their force of shop hands at that point by about 100 men.

It is said that there is a favorable prospect for the erection of a cotton-mill within the year upon the Bodwell Water Power Company's privilege at Old Town, Me. The matter is now under negotiation.

The largest olive oil factory in the world will soon be built at Los Guisicos, Cal., in Sonoma County. The plant will cost $250,000. The company has 60 acres of six-year-old trees, and is planting 700 acres.

The woolen-mill of Brutherick & Firth, at Ashland, N. H., which has been idle for a long time, will be put in operation early in the spring. Ladies' dress fabrics are the goods which it is proposed to manufacture.

Eastern capitalists are reported as having optioned the town and mineral property of the Queen City Iron Mining and Smelting Company, of Queen City, Tex., and as to erect a 50-ton iron furnace on same, if option is closed.

The Myrna Iron Company, Duluth, Minn., has filed articles of incorporation. The incorporators are A. J. Trimble, Frank Hibbing, Thomas Pressnell, R. D. Mallet and Frank L. Tedford. The capital is placed at $200,000.

The Norwood Car Replacer Company is organizing a company with W. C. Codd, president, and H. C. Thomas, secretary, for the purpose of erecting malleable iron works at Baltimore, Md. The capital stock is to be $100,000.

The pipe manufacturing establishment of Shickle, Harrison & Howard (St. Louis, Mo.,) has erected branch works at Bessemer, Ala., which is turning out 200 tons of pipe per day. Its capacity is to be increased to 800 tons daily.

W. H. Buck and J. W. Chew, of New York, and R. P. Hix have, it is stated, made an offer of $260,000 for the purchase of the Columbia (S. C.) canal, with a guarantee to complete same and erect a $1,000,000 cotton factory on its banks.

Norman W. Henly & Co., 150 Nassau street, New York, issue a catalogue of scientific and practical books, published by the firm. This catalogue embraces books that mechanical engineers and mechanics will be interested in.

It is reported that a large cotton factory will be erected at Dawson, Ga., this year, to spin the crop raised in that county, and that an effort will be made to get an extension of the Columbus Southern Railroad from that point.

New York parties, represented by J. T. McKiney, have purchased a large tract of land adjoining Atalla, Ala., and organized a $500,000 stock company to improve same. The erection of a $200,000 cotton-mill is projected by the company.

A New York and Philadelphia plate-glass manufacturing syndicate, which will make nothing but a high grade of plate glass, and will employ 600 men, has decided on a site at Christy Park, near McKeesport, Pa., for a plant that will cost $1,500,000.

The Galesburg Union Manufacturing Company, of Galesburg, Ill., with a capital stock of $100,000, has been incorporated, to carry on a foundry, a machine shop and planing mill; incorporators, Olof Hawkinson, Aaron Linnenott, N. M. Burgland and Nels Nelson.

The American Steam and Air Engine Company have been organized at Portland, Me., for the purpose of manufacturing patent steam and air engines. The officers are: President, Granville Cash, of Chelsea, Mass.; treasurer, H. M. Bullock, of Franklin, Mass.

H. J. Barron, engineer and contractor for steam-heating apparatus, 74 Cortlandt street, New York, has issued a handsome illustrated catalogue of steam boilers, radiators, and appliances used in the business. The catalogue contains information of interest to engineers and others.

The projectors of the seamless bag factory for Sherman, Tex., have met and ratified the articles of agreement with the citizens, and a surveyor has been on the ground to lay out streets and alleys, and the factory site. Much of the capital is taken in Sherman, Galveston and other points in Texas.

A party of Chicago and Pittsburgh capitalists, with a number of manufacturers from Wales, have located a sheet-steel and tin-plate-mill in South Joliet, Ill. The plant will cost $500,000 when completed. The Lewis Brothers, now of Pittsburgh, formerly of England, are at the head of the enterprise.

Work has been resumed at Norristown, Pa., on the incomplete plant of the Norristown Steel Company. The buildings were mostly under roof and contracts for machinery placed when the capital of the projectors failed. The citizens of the place recently subscribed $30,000, which, it is expected, will complete the work.

The new shoe factory of Knipe Brothers, now building at Ward's Hill, Haverhill, Mass., is nearly completed, and it is expected to be finished by the middle of March. The factory will be equipped with all modern appliances and the most improved machinery. In its full capacity it will give employment to 360 hands.

The Chester Twist Drill and Tool Company, Chester, Pa., have issued a price list of their spiral forged drill. By their process of manufacture, to which especial attention is given, the spiral is forged in the steel rod in solid dies, giving, it is claimed, the best stock in the drill at the center, where it is required.

A telegram from Joliet, February 13, says: "A party of Chicago and Pittsburgh capitalists, with a number of manufacturers from Wales, to-day located a sheet-mill and tin-plate-mill in South Joliet, Ill. The plant will cost $500,000 when completed. The Lewis Brothers, now of Pittsburgh, formerly of England, are at the head of the enterprise."

The Newport Rolling and Muck Bar-mill, of Newport, Ky., is to be removed to Salem, Va., and a company, with a capital stock of $150,000 has been organized to operate the plant. The incorporators are: J. W. Momeldorf, of Cincinnati, Ohio; J. J. Bright, of Point Pleasant, Ohio, and others. A site for the new plant has been purchased, and work is to commence shortly.

The Campbell & Zell Company (Baltimore, Md.,) have issued a finely illustrated catalogue of the Zell Improved Safety Water Tube Boiler, which this company manufactures. In addition to cuts of the boiler in different positions, and of details, there are two cuts representing "awful examples" of the explosion of boilers of another type. In the text the boiler is described, and reports of tests given.

The Pittsburgh Reduction Company, Pittsburgh, Pa., issue a catalogue relating to aluminum, giving its various properties. Referring to its use in making castings, the catalogue says: "The influence of aluminum in cast-iron is to turn the combined carbon into graphite—that is, to make the white iron gray, and also to close the texture of the metal. It makes the metal ordinarily more fluid, and it also makes it susceptible of taking a better polish, and retaining it free from oxidation. Aluminum will also increase the tensile strength of many grades of cast iron, and aids in obtaining sound castings free from blow holes. It has been used in proportions from one-tenth of one per cent. upwards with good results, with various grades of iron."

The Use of Aluminum in Iron Foundries.

Mr. David Spence writes us:

During the past winter I have used aluminum in foundry practice, and find that it is a splendid thing to make iron fluid and clean. It seems to take all the impurities out of the iron when it is charged in the cupola with the pig-iron. Ten pounds of Cowles' ferro-aluminum to 2,000 pounds of pig-iron will produce good, sound castings free from blow-holes.

It is as good in the use of crucible steel as in iron (its effects). It produces a sharp and solid casting, makes a uniform grain; it takes away the tendency to chill in cast-iron.

In steel it reduces the shrinkage, and increases the welding properties in both wrought-iron and steel.

I recommend it to persons making tool castings, such as face plates, and in fact all kinds of work that has to be planed, milled or turned.

There is one thing that I like in its use, and that is, it does not weaken the iron or take the strength from it, but rather adds to it. We are having good success with it in sewing machine castings. I believe in progress in foundry practice, and am always willing to give such things a trial, if I find that they are a benefit.

I want other foundrymen to know it. I believe we are making rapid progress in American foundry practice, and the foundryman that is satisfied to run his foundry in the same old-fashioned way his grandfather did, he is going to get left. And the younger and more progressive men will come to the front.

Loss in Melting Iron.

By George O. Vair.

I have often asked the question, "What percentage of loss is there in melting iron?" and, judging from the answers received, concluded that the majority of foundrymen guessed at it, as no two would be alike. It is a hard matter to get the loss absolutely correct, for the reason of small quantities

being lost in casting and in chipping castings. The heat herein given was taken off recently with the following results:

CHARGES.	Sidney, No. 2.	Dexter, No. 2.	Bessie, No 1.	Bay View, No. 2.	Southern Soft, No. 1.	Machinery Scrap.
1	1800	400	300	200	500	1800
2	300	.....	400	200	500	500
3	300	.....	400	200	500	500
4	300	.....	400	200	500	500
5	300	.....	400	200	500	500
6	300	.....	400	200	500	.....
7	300	.....	400	200	500	.....
8	300	.....	400	200	500	....
9	300	.....	400	200	500	.....
10	400	.....	500	500	600	.....
Total	4,600	400	4,000	2,300	5,100	3,800

CHARGES.	Foundry Scrap.	Car Wheels.	Millings.	Iron on each Charge.	Coke.	Coal.
1	.....	.....	.....	5,000	1,350	200
2	.....	300	.....	2,200	250	.....
3	.....	300	.....	2,200	250	.....
4	.....	300	.....	2,200	250	.....
5	.....	300	.....	2,200	250	.....
6	500	300	.....	2,200	200	50
7	800	.....	.....	2,200	200	.....
8	800	.....	.....	2,200	200	.....
9	800	.....	.....	2,200	200	.....
10	1,300	.....	100	3,400	100	.....
Total	4,200	1,500	100	26,000	3,250	250

45" Colliau cupola.

Ratio of fuel to iron, 1 to $7\frac{49}{100}$.

Good castings..... 21,314 pounds.
New scrap..... 3,005 pounds.
Millings..... 200 pounds.
Loss of metal..... 1,481 pounds.

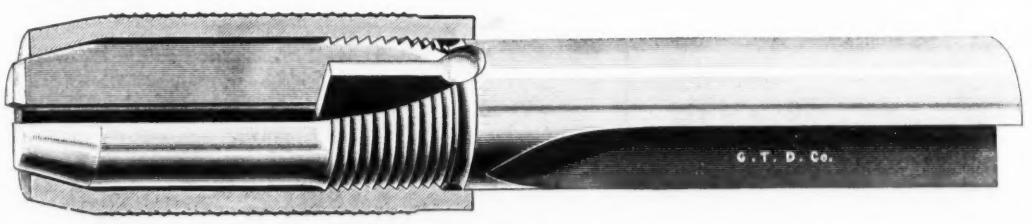
Amount melted.....26,000 pounds.
Loss of metal, $5\frac{69}{100}$ per cent.
Ratio of loss, 1 to $17\frac{55}{100}$.

The object in giving charges of iron is simply to show what kind of iron was used. The amount and quality of scrap, I think, would cut quite a figure in percentage of loss.

A New Twist Drill.

The accompanying engravings represent a drill chuck and twist drill, which, as will be seen, is somewhat of a departure from the regular form, so far as the shank of the drill and the chuck for holding it are concerned.

Fig. 1.



A NEW TWIST DRILL.

The body of the drill is of the regular "increase twist" straight lip form, and is ground to size, and backed off with special machinery, so that standard sizes and free working are insured.

The groove, however, instead of terminating at the beginning of the shank, is continued through it in the form shown, and it is then held in a chuck, such as is shown by the engraving, which has two jaws adapted to fit the grooves in the shank of the drill, and to be clamped tightly in them by the threaded and knurled sleeve shown. The jaws are not loose, and their distance from each other does not vary with the different sized drills placed in the chuck, since the shanks of the drills for a given series are of the same thickness through the center, and are held in the chuck in the manner indicated by Fig. 1, which represents an end view of the chuck, showing the jaws with circles of different sizes, representing the different sized drills in place, the smaller drill being of the same thickness through the center of the shank, and having correspondingly shallow grooves. It will be seen that the drill is thus driven positively, and does not depend at all upon the tightness of the grip secured by the jaws, but the largest drills are secured in the chuck, and removed from it after doing the heaviest work, simply by applying the hand to the knurled shell of the chuck, without the use of a wrench, for which there is no provision. The plate seen at the bottom of the jaws serves to insure that the drills shall be inserted to the right depth, and as it is loosely held in position, gives opportunity for the slight springing of the jaws above the end of drill necessary to secure it.

The grooves are milled on both sides simultaneously by special machinery, and are afterwards ground to size while held in a chuck, which grips them by these grooves, so that a true drill is insured.

Only two sizes of chucks are used for the full range of sizes of drills, the smaller chuck taking drills from $\frac{1}{4}$ to $\frac{3}{4}$ inch, and the larger size, all drills above $\frac{3}{4}$ inch. The chuck shown is the smaller size, and its shank is grooved to be driven by the larger chuck, though the shanks of either sized chuck may, of course, be of any desired form to suit the machine in which they are to be used. Both sizes are regularly kept in stock with standard Morse taper shanks.

Specimens of these drills and chucks, which have been examined by us, show excellent workmanship, and they have been tested in some of the best known shops of the country with entire satisfaction. They are made by the Graham Twist Drill Company, Detroit, Mich.

Dr. Otto.

We referred in a few lines, last week, to the death of Dr. Otto. We give below a more complete account of his life, copied from London *Engineering:*

"We regret to record the death, at Cologne, on January 26, of Dr. N. August Otto, the inventor of the Otto gas engine. He succumbed, after a brief illness. His career exemplifies the success of perseverance and energy paired with skill and ingenuity. Luck often follows pluck, and a false start is not fatal. Mr. Otto started as a commercial traveler, for which duties his great mechanical skill was of little avail. Some circumstance turned his attention to gas engines, where his commercial capacity remained valuable. In 1867, he, in conjunction with Eugen Langen, surprised the engineers who had flocked to the Paris Exhibition, with a real practical gas engine, an engine of the vertical type, with fly-wheels on the top, not uncanny in appearance, but terribly noisy. The noise had to be borne, and was borne—for the new engine became very popular—for nine years, when the 'Otto Silent' was presented. That engine has undergone such manifold improvements by the inventor and by Messrs. Crossley, that startling innovations and perfections are hardly to be looked for.

"The gas engine in its practical career has thus quickly attained maturity. Yet the early history of the gas engine has to go back more than 200 years. It is orthodox to quote Huyghens as the first in the field; the series of originators commences, therefore, with one of the best names of physical science. Among the papers of the great physicist is one dated 1640, on a 'Novel Motive Force Derived from Gun-powder and Air.' Papin took this idea up in 1688, one year after his classical experiment which initiated the steam engine; but he was not satisfied with the results. Fully a century latter, Street reopened the researches by bringing out and patenting a motor cylinder with explosion by means of a torch. Many others followed: Lebon, Samuel Brown, Wright, Barnett, Newton, Barsanti and Matteucci, Million, and Lenoir and Hugon, who came very near producing a practical engine. But Langen and Otto's engine of 1867 was so decidedly superior in the economy of gas consumption, that the Lenoir and Hugon engines were at once put out of the field. Otto's gas engine embraced the characteristic features of some of its predecessors—it is rarely otherwise in our days—the compression of Barnett, the cycle of Beau de Rochas, and the free piston and other advantages of Barsanti and Matteucci's engine, which was remarkable in many respects and effected ignition by means of the electric spark. But engineers remain indebted to Dr. Otto for supplying an engine which realized and did what others, who deserve all credit, had been aiming at. We will not here contest the question of priority of invention. It has been fought out many a time; and we believe that no one will grudge Dr. Otto the benefits and comfort which his work and exertions brought him."

The Tunnel Collision.

On the morning of the 20th, a collision occurred in the Fourth avenue tunnel above the Grand Central station, this city, by which seven people lost their lives, and others were injured. At the present writing it is impossible to say just what the immediate cause of the accident was; those who were responsible for the correct placing of the signals insisting that they were right, and that there was no possibility of their being otherwise, while the trainmen of the rear train, which crashed into the one ahead, insist that they were running strictly in accordance with the signals displayed, which indicated a clear track ahead. The investigation now being made by the coroner or that which is to be made by the Railroad Commission, may bring out facts which will show the real truth of the matter. But in the meantime it is safe to say that this collision was due to some defect of the system of signals, which allowed them either to be set wrong or to be disregarded by the trainmen when set right; and, so long as there are automatic systems of block signals in successful use, which cannot be set wrong, and which compel enginemen to heed them or be derailed, it would seem as though some one was to blame for the failure to have such a system in use on this piece of track, where, if anywhere in the world, the most perfect system known should be in use; two hundred and fifty trains passing daily over the two tracks in the tunnel. The system in use there was, a few years ago, the best known system, but to day it is not so, because, notwithstanding its apparent perfection, and the safeguards which it seems to provide against accident, it depends, finally, upon the eternal vigilance of telegraph operators and signalmen, while the latest improved automatic systems do not so depend, but are entirely automatic, worked by the trains themselves through the medium of electricity and compressed air, and are so arranged that any derangement of the system whatever immediately sets every signal at danger, and keeps it there until the trouble is removed. It is altogether probable that, had such a system been in use in the tunnel, the accident would not have occurred.

Fire followed the collision, and some of the victims were frightfully burned. This was, by the daily press, quite generally charged to the car stove, though the evidence seems to be conclusive that it originated with the headlight of the colliding engine.

A correspondent writes: "I should be better able to judge of the value of Mr. Knoeppel's method, if he will kindly inform your readers how many flange pulleys or sheave wheels of the size named he is able to make in a day by his method, or what price, if made by the piece."

The recent and increasing mine disasters—for the most part a disgrace to civilization—bring out one fact; that is, how little real difference there is between men. The manner in which miners work, with death looking straight at them, to rescue imprisoned comrades, has never been surpassed in all the annals of heroism. Yet, according to popular belief, miners are uncultured men, destitute of the feelings that inspire such deeds. How we all make mistakes, to be sure.

Machinists' Supplies and Iron.

NEW YORK, February 28, 1891.

Iron—American Pig—Though the demand for iron has been very good, and the furnaces of the Mahoning and Shenango valleys continue shut down, no improvement in prices results, as would be expected from these conditions under circumstances.

We quote No. 1 Foundry, standard Northern brands, $16.50 to $17.50; No. 2, $15.75 to $17; Gray Forge, $14.25 to $15; Southern brands No. 1 Foundry, $16 to $17; No. 2, $15.50 to $16.25; No. 3, $14 to $14.50.

Scotch Pig—The market continues dull.

We quote Coltness, $24.50; Dalmellington, $22 to $23, and Eglinton, $20.50.

Copper—The market for Lake is dull, and prices nominal. It is understood, in a quiet way, that 14c. will buy Lake, though the companies are quoting 15c. Casting brands are in somewhat better demand, with prices for large lots at 11½c.; retail, 12c.; Arizona Ingot, 12¾c. to 13c.

Lead—The market continues dull, and prices are unchanged. Values for single car-load lots, for immediate delivery, are at 4.30c. to 4.35c.

Spelter—The market is dull, and supplies seem abundant. We quote spot at 5c.

Tin—The market is still dull, and prices unchanged. Values for spot delivery are at 19.85c. to 20c.

Antimony—The market is somewhat unsettled.

We quote Hallett's, 16¼c. to 16½c. Cookson's, 17¾c. to 18c.; L. X., 17c.

Lard Oil—Prices for Prime range from 48c. to 50c., according to brand.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—Position by expert tool maker; strictly steady; is a good draftsman, and fully competent to handle men. Box 60, AM. MACHINIST.

Wanted—A competent machinist, to work on high-grade machine tools. Address Capitol Mfg. Co., Chicago, Ill.

Wanted—Situation as layer-out, or assistant foreman of boiler shop, by first-class mechanic; good references; temperate. Address Box 59, AM. MACH.

Wanted—Position as traveling salesman for machine tool builder; will sell either on commission or salary. Address Peter Shellenback, 424 N. 14th st., Richmond, Ind.

Wanted—Foreman for iron foundry running 60 molders on pipe fittings and valves. Address, giving references, and salary required. Box 50, AM. MACHINIST.

Wanted—A general foreman for a Western manufacturing company; one familiar with steam fitters' supplies preferred; must be well posted in iron-working mach'y, & fully competent to handle men advantageously. Address Box 49, AM. MACHINIST.

A machinist of good education and knowledge of steam economy, lately traveling for a firm building machine tools, wants a position as traveling salesman to sell engines or other machinery. Address Box 57, AMERICAN MACHINIST.

Wanted—A number of first-class machinists to work on ice and refrigerating machinery, and stationary engines; good wages and steady work to first-class men. Address Frick Company, Waynesboro, Franklin County, Pa.

Wanted—A good tool maker for a shop making a line of fine brass work. An experienced man who has a good record will find this a permanent place in a good shop. Address, with references, Phila., AMERICAN MACHINIST.

A practical mechanical engineer, 29 years experience in shop, drawing office, and as supt., thoroughly acquainted with steam engines, boilers, machine tools, and other specialties, millwright work and general machine shop practice, seeks a responsible position; unexceptionable ref. Dixon, AM. MACH.

Wanted—A foreman in a jobbing foundry employing from 6 to 15 men in western Illinois. Should be acquainted with general machine and architectural iron castings; a first-class man can secure a desirable situation and interest in company; state age, experience, and wages expected. Address Box 54, AMERICAN MACHINIST.

A pushing, practical foundry foreman with good executive ability in handling work and men, well up in mixing and melting metals, core making and general foundry knowledge, wants position; engine work or heavy machinery preferred. American, temperate, age 36, references A 1. Address Box 56, AMERICAN MACHINIST.

Experienced mechanical draftsman wants situation. Address Box 62, Am. Machinist.

Wanted—By a first-class machinery molder, foreman; had ten years' experience at same, and twenty years at the trade. C. R., Am. Machinist.

Wanted—First-class mechanical engineer and draftsman, that has had experience in locomotive construction; permanent position guaranteed to right party. Address "Locomotive," Am. Mach.

Wanted—First-class tool and lathe hands for night turn in a first-class shop; a few also will be needed for day turn. Address Joseph Martin, Sparrow's Point, Maryland.

Wanted—Position as superintendent of machine manufacturing company, by a practical man, occupying similar position at present; experienced in designing and building light and fine machinery. Address C. F., American Machinist.

✝ MISCELLANEOUS WANTS ✝

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Cheap 2d hd-lathes & planers. S. M. York, Clev'd, O.

Just out: aluminum steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, Ohio.

For sale—Crosby steam engine indicator. Kimball Bros., Anamosa, Iowa.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Wanted—Customers for our new Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

Wanted—Specialties for the Southern trade. Bluefield Iron Works, Bluefield, W. Va.

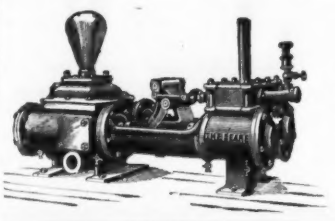
For sale—Machine shop and tools; capacity 5 or 6 men; shoe machine repairs; will take mortgage for part; other business. Box 61. Am. Machinist.

Engineers wanted to send their addresses and receive free a 25 cent book. "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

Pulsomer Pumps—Several sizes, nearly new, cheap; 8 horse-power Lidgerwood hoister, large water motor, exch'g. 165 First st., Jersey City, N. J.

Wanted—Engineers to write for catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.

For sale—One set of Whitworth's taps and reamers, comprising sizes 5/8, 11/16, 3/4, 13/16, 7/8, 15/16, 1, 1 1/16, 1 1/4, 1 3/8, and 1 1/2" diameter. There are three assorted taps, and one master tap; and one taper and one straight reamer to each dimension. This set has never been used, and cost $250. We will sell at a sacrifice for $125. Frasse & Co., 92 Park row, N. Y.



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STEAM PUMPS
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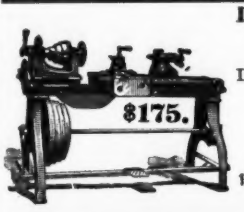
The Finest Tool & Die STEEL



Improved Screw Cutting Foot and Power. LATHES
Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.
THE SEBASTIAN-MAY CO.,
167 to 176 Highland Avenue, SIDNEY, OHIO.
MONTGOMERY & CO., 105 Fulton St., New York, Gen'l Agents.

BRADLEY AND HAMMERS FORGES
BEST HAMMERS IN THE WORLD RUN BY BELT
OVER 1500 IN USE.
Three Styles, 15 lb. to 500 lb. Heads.
Our FORGES heat irons fast enough to keep Hammers and Men fully employed. Send for Catalogue and Prices.
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TOBIN BRONZE
Tensile Strength upwards of 79,000 lbs. per sq. in.
Torsional Strength equal to the best Machinery Steel.
Anti-Frictional and Non-Corrosive
CAN BE FORGED HOT.
Round, square, and hexagon bars for pump, piston rods, bolts and screws. Yacht shafting. Rolled sheets and plates for pump linings and condenser tube sheets, &c. Spring wire.
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19 & 21 CLIFF ST., NEW YORK.
Send for Circular.

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New edition for 1891 sent by mail free to any one ordering it.
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FINE TAPS, DIES, REAMERS, Etc.

LIGHTNING AND GREEN RIVER Screw Plates.
Bolt Cutters, Hand and Power Drilling Machines, Punching Presses, Tire Benders, Tire Upsetters and Other Labor-Saving Tools. Send for Price List.
WILEY & RUSSELL MFG. CO., GREENFIELD, MASS. New York Office, No. 126 Liberty St.

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20 YEARS WITH INDICATOR
Sold to September 3d, 1890. Vols. 1 and 2 in one vol., $2.50
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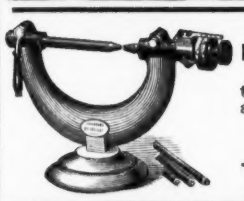

SWEET'S Measuring Machine.
The only micrometer that will not lose its accuracy by wear.
Satisfaction Guaranteed.
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For TOOLS, DRILLS, DIES, &C.
All Kinds in Stock.
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MANUFACTORY,
WILLIAM JESSOP & SONS, L'D. | SHEFFIELD, ENGLAND. | Chief American Office, 91 JOHN ST., NEW YORK.

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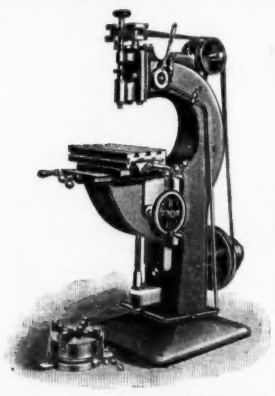
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An indispensable Tool in any well appointed machine shop.
Speeds from 240 to 10,000 revs.
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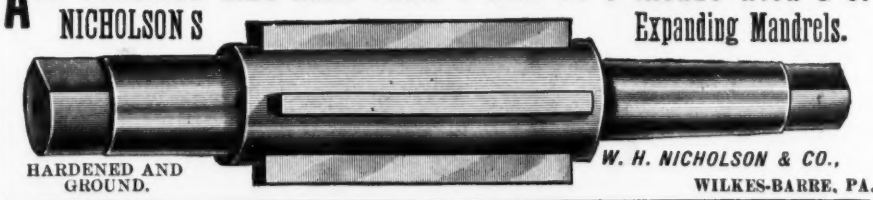
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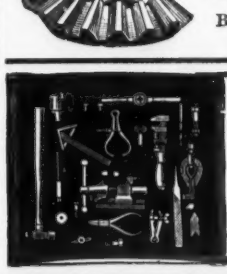
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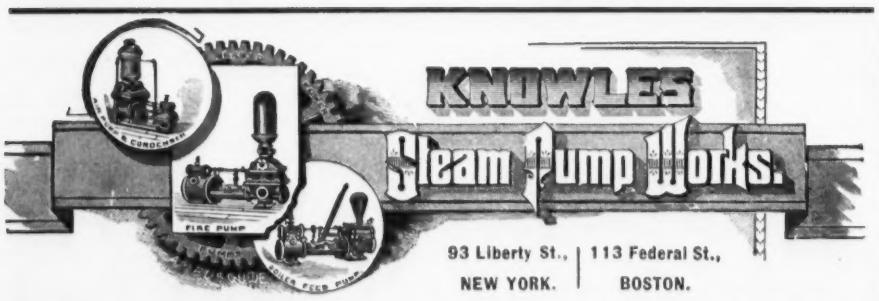

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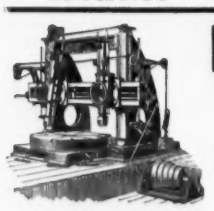

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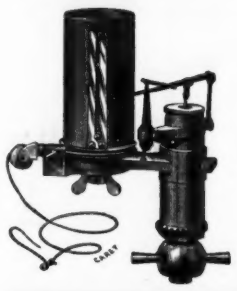

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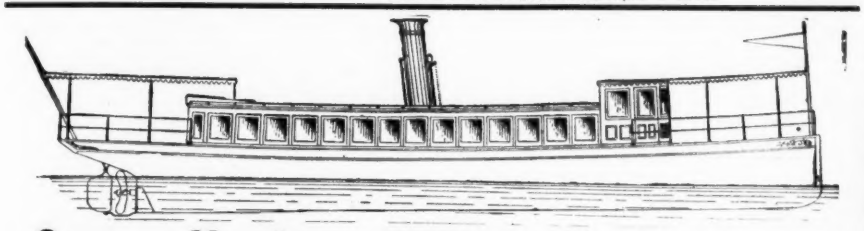

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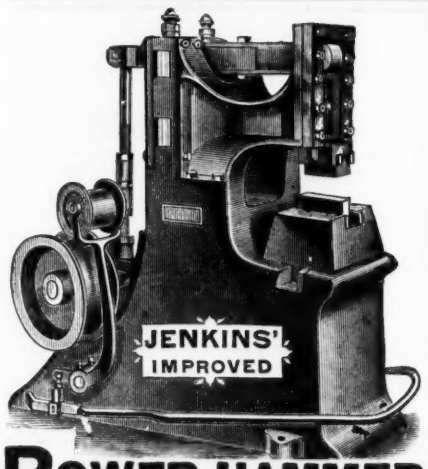

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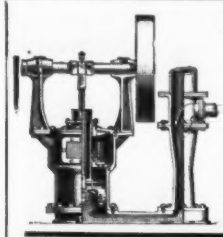

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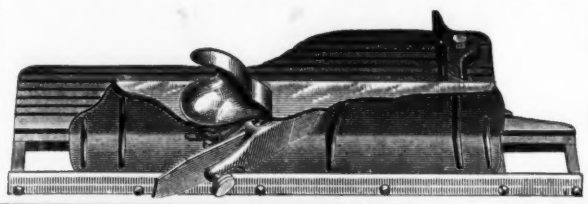

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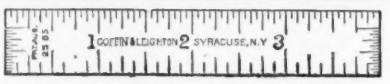

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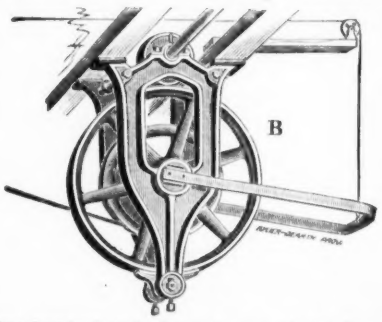

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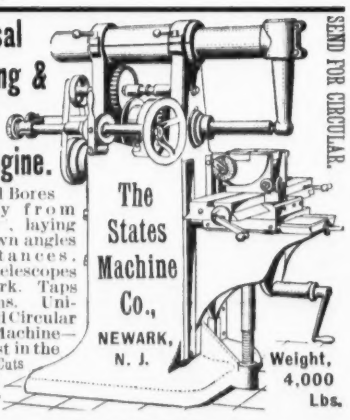

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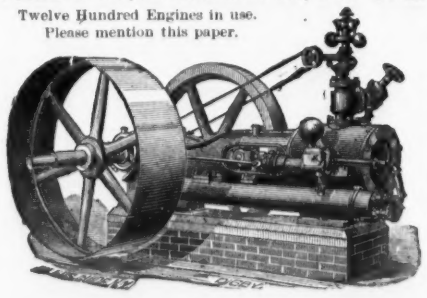

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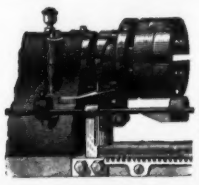
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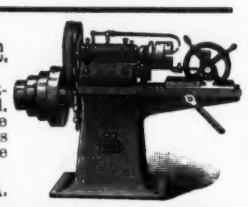

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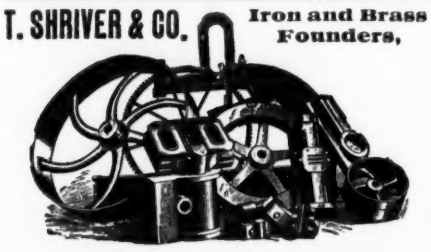
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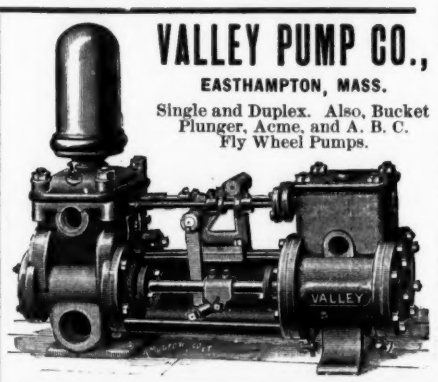

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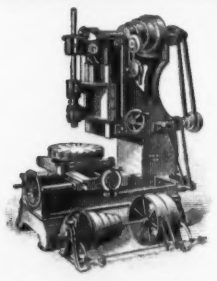
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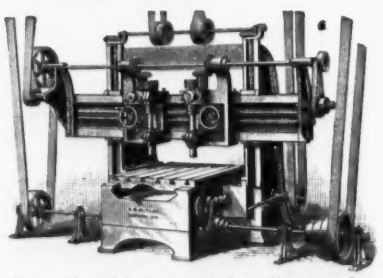
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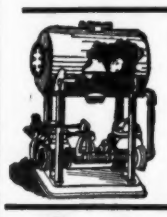
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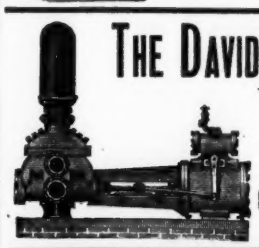
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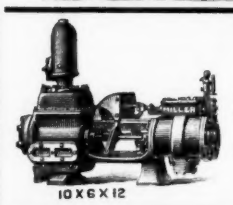
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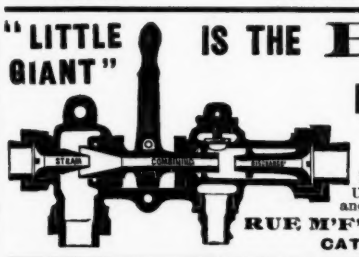

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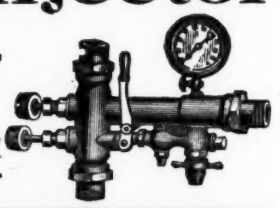

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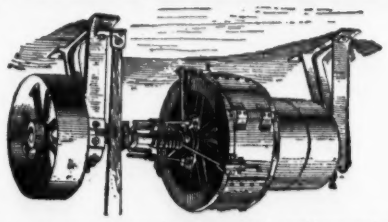
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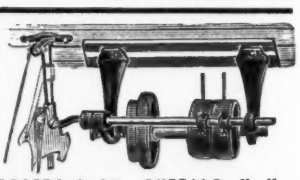
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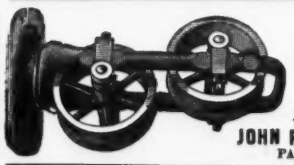
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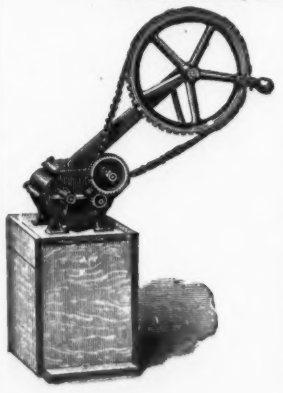
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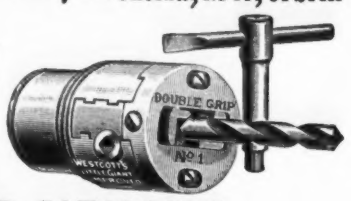

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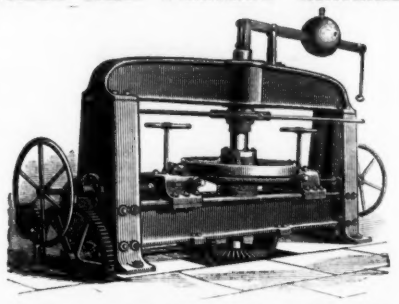

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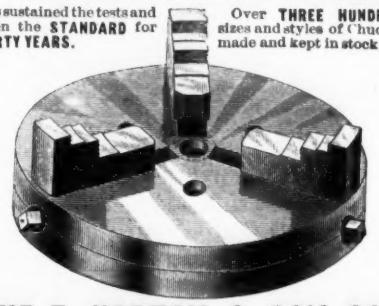

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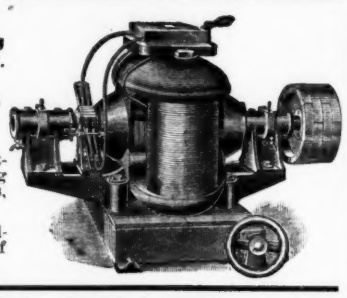

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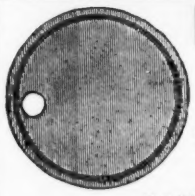

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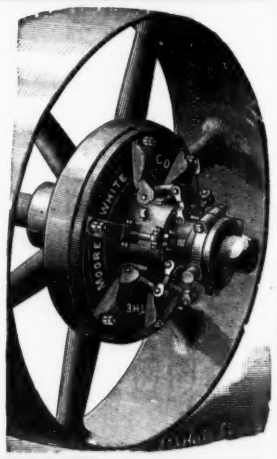

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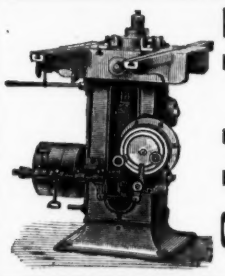

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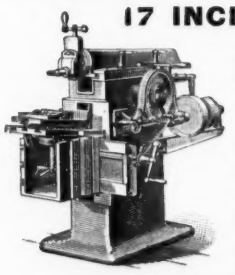

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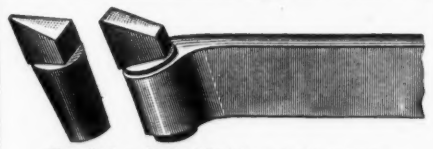

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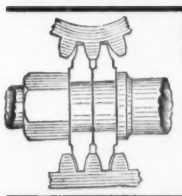

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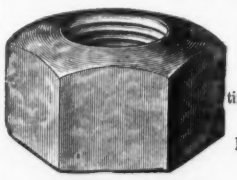

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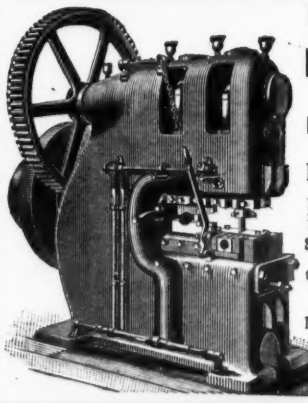

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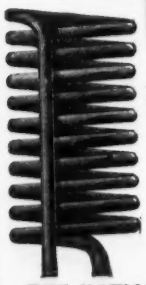

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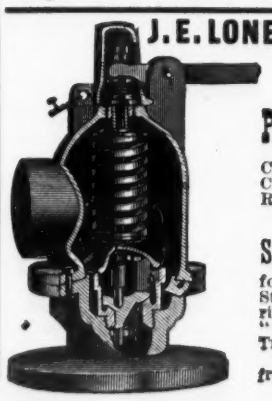

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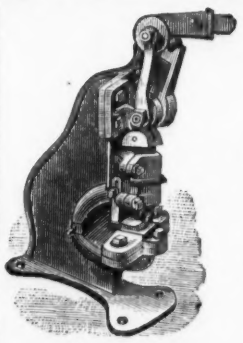

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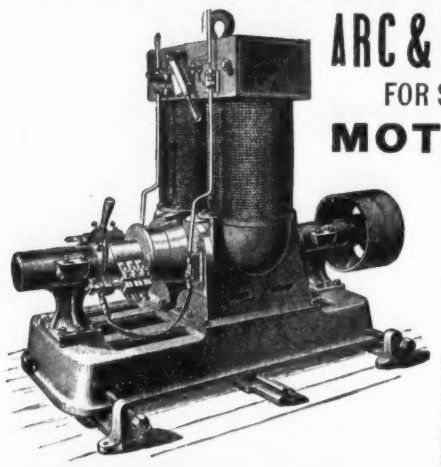

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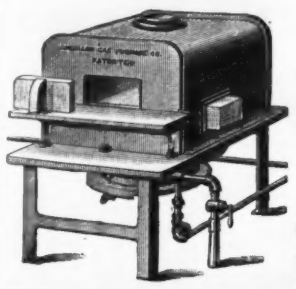

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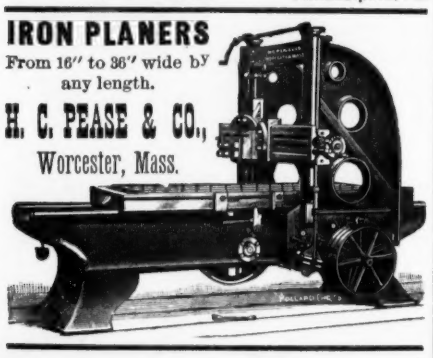

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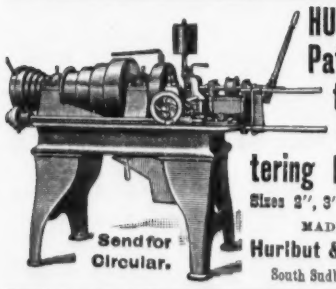

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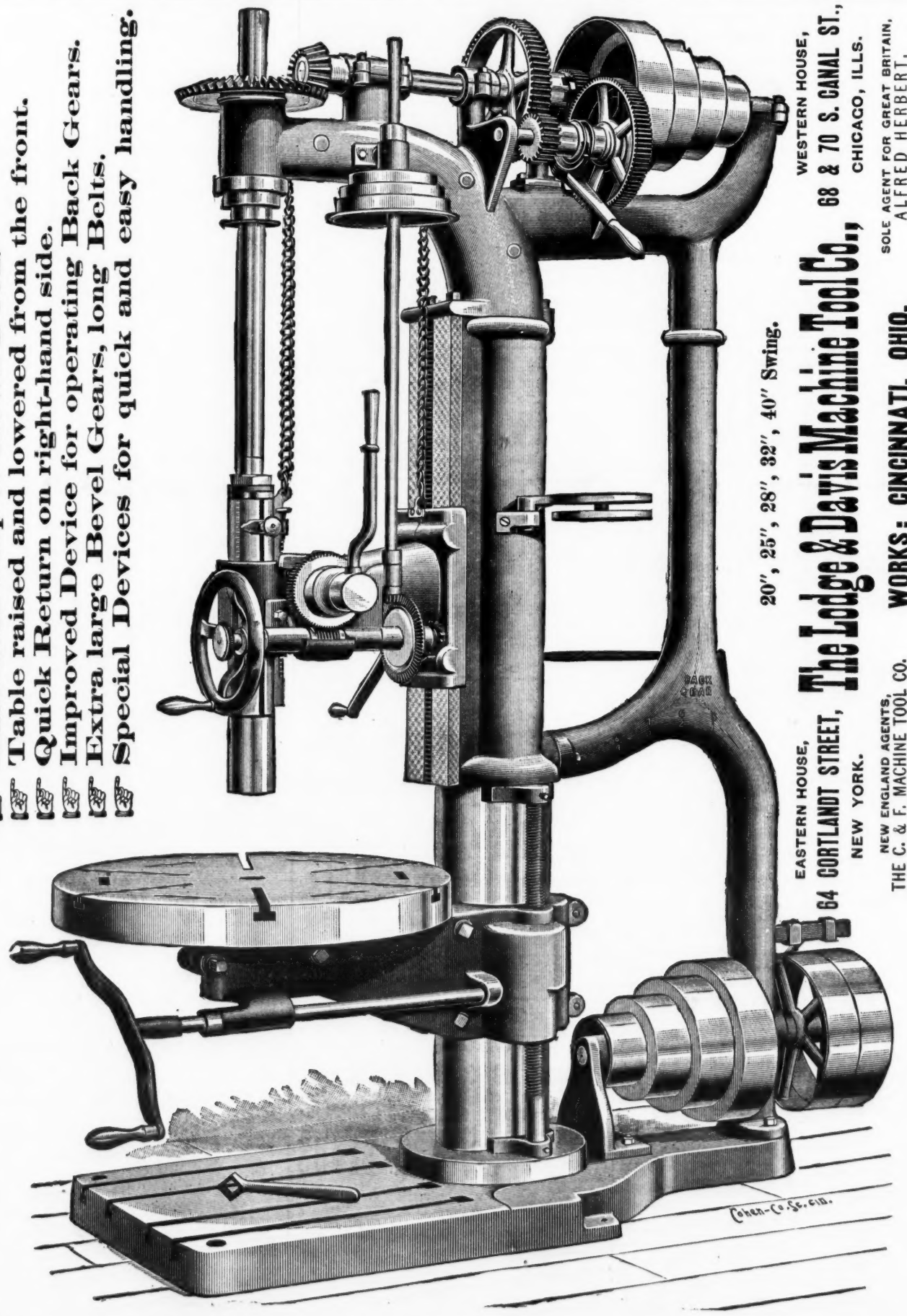

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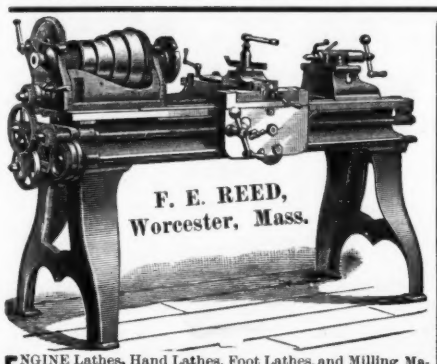

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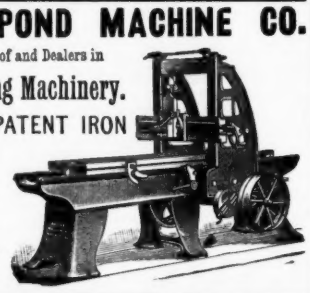

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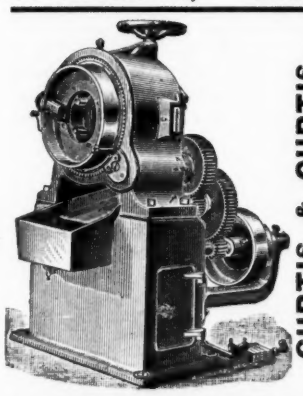

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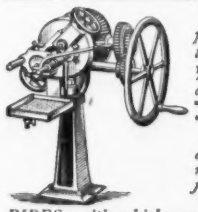

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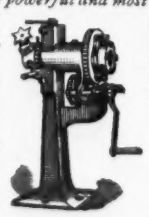

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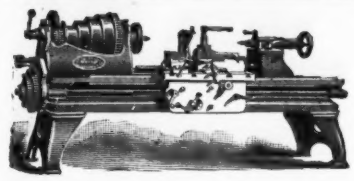

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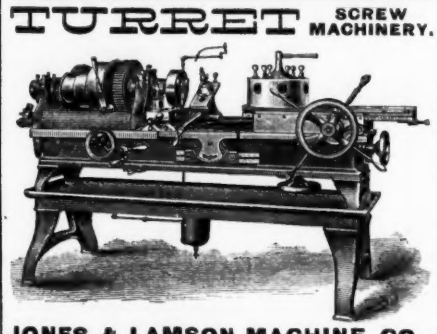

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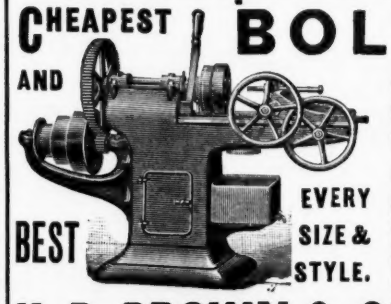

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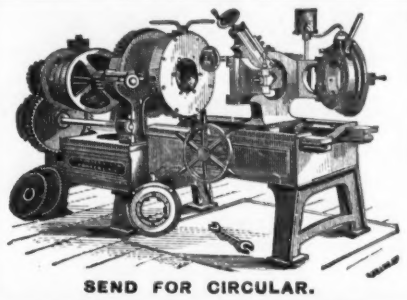

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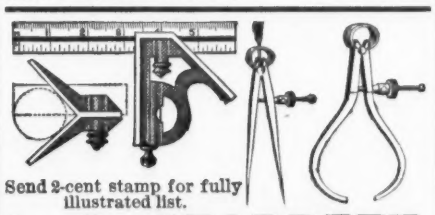

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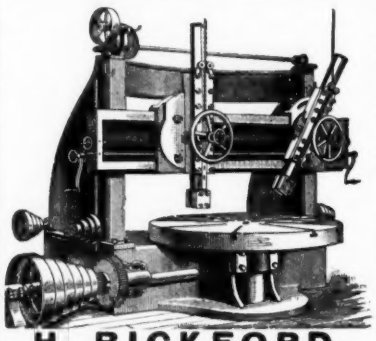

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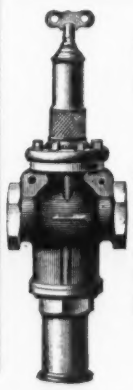

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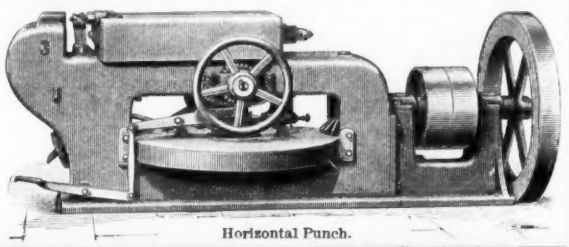
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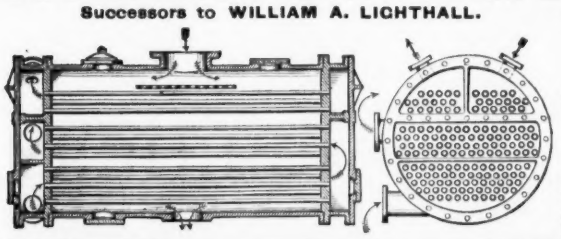

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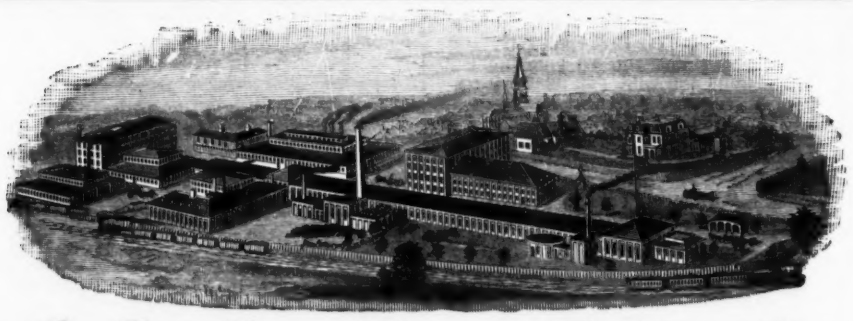

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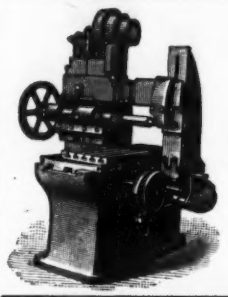

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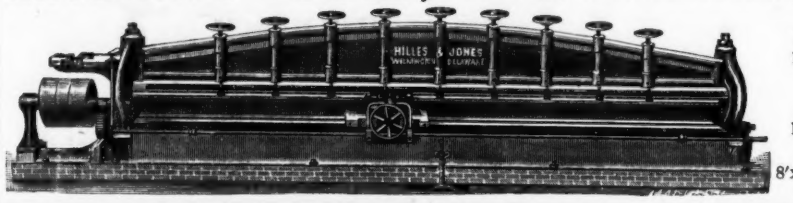

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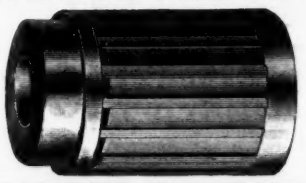

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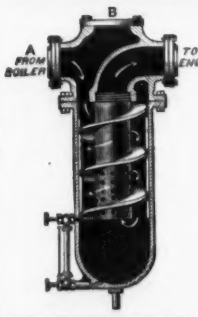

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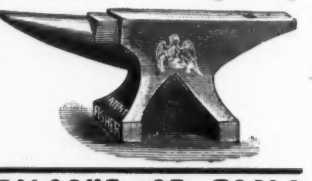

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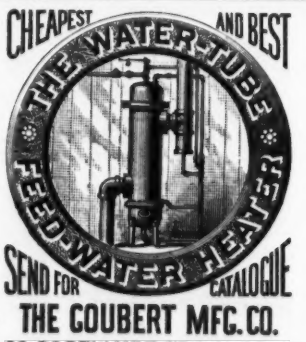

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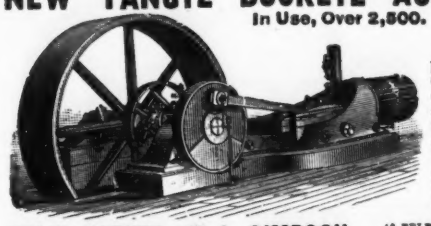

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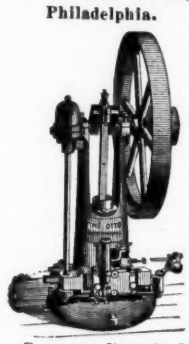


35,000 SOLD.

Many New Improvements FOR USE WITH

COAL GAS, NATURAL GAS, PRODUCER GAS, OR GASOLINE.

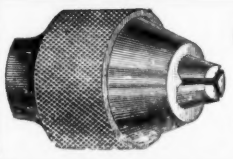
COMBINED "OTTO" GAS ENGINES AND PUMPS.

Consume 25 to 75 Per Cent. Less Gas than ANY other Gas Engine doing the same work.

Portable GASOLINE Engines

For Threshing Machines, Hay Presses, Corn Shellers, Pile Drivers, Well Diggers, &c., our newest and latest Engine a little wonder and a *giant to work.* *Send for prices. Mention this paper.*

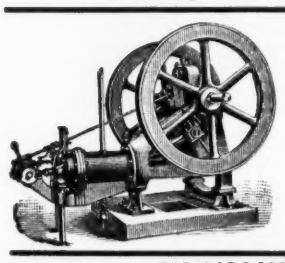
Van Duzen Gas & Gasoline Engine Co.
CINCINNATI, OHIO.



Almond Drill Chuck

Sold at all Machinists' Supply Stores.

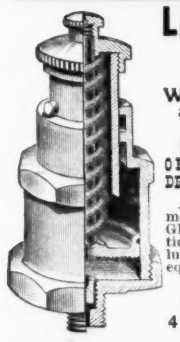
T. R. ALMOND,
83 & 85 Washington St.
BROOKLYN, N. Y



ATKINSON CYCLE GAS ENGINE.

Four strokes of piston in one revolution of crank-shaft, expanding the charge to more than the original volume, driving out *all* the products of combustion, and giving a working stroke at every revolution and in half the time required by any other engine. *Send for Illustrated Circular.*

HENRY WARDEN, MANUFACTURER,
1810 ALLEGHENY AVENUE, PHILADELPHIA, PA.



LACKAWANNA GREASE CUP

Will Save its Cost in Oil alone Several Times per Annum.

SAVES ALSO IN LABOR AND COST OF COTTON-WASTE. PREVENTS DRIPPING AND SPATTERING.

A POSITIVE FORCE FEED with the most PERFECT REGULATION and GREATEST CONVENIENCE in operation yet attained in any device for the lubrication of machinery. Works equally well in every possible position.

Lackawanna Lubricating Co.,
41 Coal Exchange, Scranton, Pa.

MACHINERY.

***IN STOCK.* (New.)**

Engine Lathe,	13 in. x 6 ft., 7-8 in. hole.	Ames Mfg. Co.
" "	14 in. x 6 ft., 16 in. x 8-8 ft., 18 in. x 8 ft.,	Fitchburg.
" "	24 in. x 12 ft., complete,	Fitchburg.
" "	14 in. x 6 ft., with taper attachment,	Fitchburg.
" "	12 in. x 6 ft., 16 in. x 6-8 ft., 18 in. x 8 ft.	Prentice.
" "	16 in. x 6 ft., 20 x 10 ft., 27 x 12 ft.,	Lathe & Morse.
" "	15 in. x 6 ft., Cpd Rest, Cross feed,	Prentice.
" "	14 in. x 6 ft., 16 in. x 6-8 ft.,	Hendey.
" "	16 in. x 6 ft., 18 in. x 6 ft., Tapers,	Hendey.
" "	16 in. x 6 ft., 18 in. x 8 ft., 24 in. x 12 ft	Wright.
" "	16 in. x 8 ft., 24 in. x 12 ft., 36 in. x 14 ft.,	Perkins.
" "	28 in. x 16 ft., 32 in. x 18 ft.,	Fay & Scott.
Planer,	16 in. x 16 in. x 4 ft.	Hendey.
"	22 in. x 6 ft., 24 in. x 6 ft.,	Lathe & Morse.
"	24 in. x 6 ft., 25 in. x 8 ft.,	Fitchburg.
"	24 in. x 6 ft., 30 in. x 8 ft., 36 in. x 14 ft.,	Powell.
Drill,	20 in. Comb. Wheel and Lever Feed.	Prentice.
"	21 in. Back Gears and Wheel Feed	"
"	25-28-32 in. complete.	"
"	28 in. complete.	Snyder.
Shaper,	14 in. Trav. Head complete.	Fitchburg.
"	16 24-30 in. stroke,	Eberhardt.

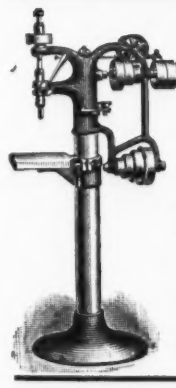
Millers, Universal and Plain. New Styles.
Brass Lathes, Turret and Square Arbor, all sizes.
Pattern Makers' Lathes. New Styles, all sizes.
Combined Punch and Shears 22½ in. reach.

***SECOND-HAND.* (Low Prices.)**

Engine Lathe,	36 in. x 18 ft., modern style,	Putnam.
" "	26 in. swing, 6 ft. bed,	fair, order.
" "	25 in. " 10 ft. "	" "
" "	20 in. " 8 ft. "	good order.
" "	15 in. " 5 ft. "	good order.
" "	13 in. " 6 ft. "	fair order.
Bement Axle Lathe, Regular pattern,		good order.
Cabinet Turret Lathe No. 2, Am. Tool Co.,		A1.
Planer, 24 in. x 6 ft., Walters,		good order.
"	30 in. x 6 ft., 30 in. x 8 ft., Fitchburg.	good order.
"	42 in. x 42 in. x 12 ft., Fitchburg,	good order.
"	48 in. x 45 in. x 11 ft., Burns,	good order.
Shaper, 24 in. Friction, Hendey,		A1.
Screw Machine, Niles Tool Works, 2 in. hole, auto. feed, complete with tools,		good order.
Power Boiler Rolls 8 ft.,		good order.

Send for March List.

J. J. McCABE,
SUCCESSOR TO
E. P. BULLARD'S
N. Y. Mach'y Warerooms.
68 Cortlandt Street,
NEW YORK.



THE NORTON DRILLS.

FOR LIGHT, SENSITIVE AND RAPID DRILLING.

1, 2, 3, 4 or more Spindles, Sensitive or Automatic Feed.
To drill from 0 to 1-2 inch holes.
The *Latest* and *Best*; most convenient, sensitive and durable Drill on the market.
Have Balanced Spindles and Balanced Tables.
Write for prices and description, or for Special Machinery.

THE NORTON & JONES
Machine Tool Works,
PLAINVILLE, CONN.
Manufacturers of Machine Tools and Special Machinery.

OUR NEW CATALOGUE OF MACHINE TOOLS,

For General Machine Shop Use,

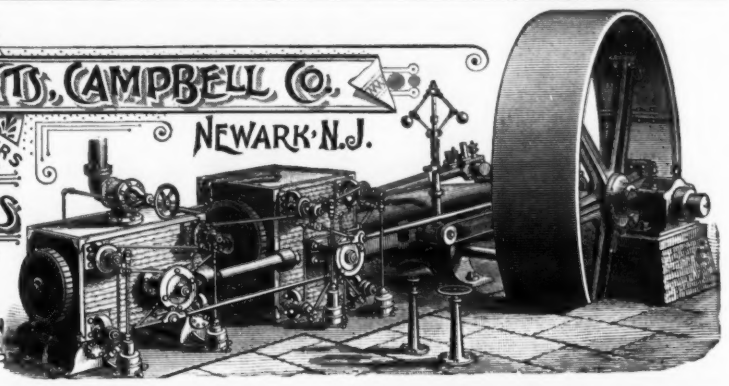
Will be sent to Manufacturers, on application.

BRIDGEPORT MACHINE TOOL WORKS,

E. P. BULLARD, Prop. BRIDGEPORT, CONN.

THE WATTS, CAMPBELL CO.

MANUFACTURERS OF IMPROVED CORLISS STEAM ENGINES IN FULL VARIETY.
CONTRACTS TAKEN FOR COMPLETE POWER PLANTS.
NEWARK, N.J.



Eclipse Corliss Engine.

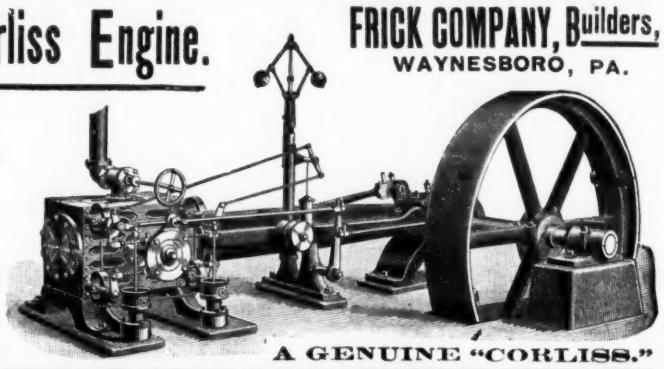
FRICK COMPANY, Builders,
WAYNESBORO, PA.

NON-CONDENSING,
CONDENSING COMPOUND,
40 TO 1,000 H.P.

Send for Circulars.

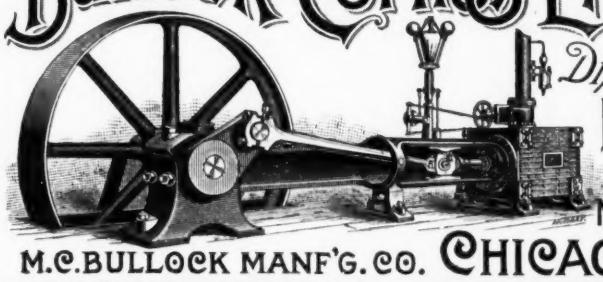
ICE-MAKING AND REFRIGERATING MACHINERY.

Send for Special Circular.



A GENUINE "CORLISS."

Bullock-Corliss Engines.



DIAMOND DRILLS —FOR— PROSPECTING.
BAND FRICTION HOISTS,
MINING MACHINERY.

M. C. BULLOCK MANF'G. CO. CHICAGO, U. S. A.

Corliss Engines

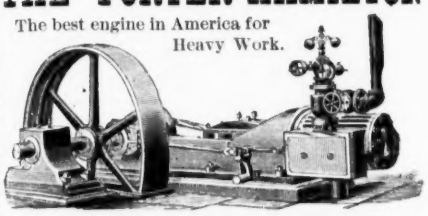
Of the highest type, in all sizes, are made by

The Lane & Bodley Co.
CINCINNATI, O.

The merits of their engines are described in an illustrated pamphlet, which will be sent to any one interested.

THE PORTER-HAMILTON

The best engine in America for Heavy Work.



WILLIAM TOD & CO.,
Youngstown, Ohio.

NOTICE THIS OFFER.

WE HAVE FOR SALE A LOT OF

NEW IRON PLANERS

To Plane 24 in. x 24 in. x 6 ft.,

WEIGHT, 4,500 LBS.

Guaranteed to be well made.

Net Cash Price Each $400.

SEND FOR PHOTOGRAPH.

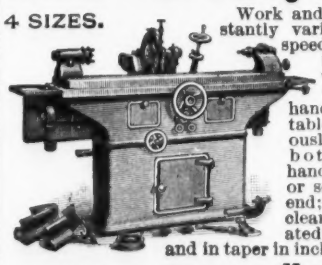
HILL, CLARKE & CO.,

156 OLIVER ST., BOSTON, MASS.

Geo. D. Walcott & Son
Manufacturers of
Lathes & Shapers,
JACKSON, MICH.
Write us for photo and prices.

Universal AND Plain Grinding Machines,

4 SIZES.



Work and traverse instantly varied to any speed between extremes. Reversing points varied by hand. Pivoted table simultaneously clamped at both ends by hand, has no slot or screws on its end; easy to keep clean; is graduated in ¼ degrees and in taper in inches per foot.

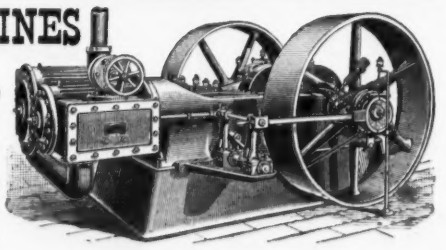
LANDIS BROS. Manufacturers, Waynesboro, Pa.

BALL AUTOMATIC ENGINES

WORKS: ERIE, PA.

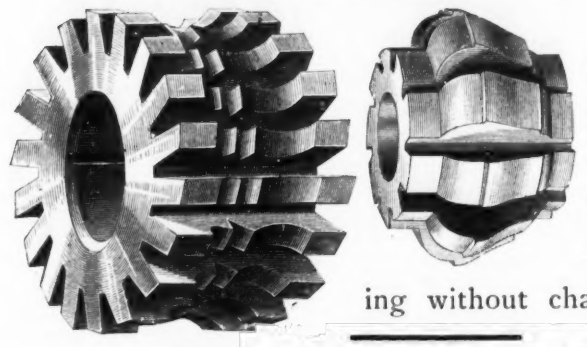
High-Pressure, Compound and Triple Expansion, Condensing and Non-Condensing.

CHARLES R. VINCENT & CO.,
Contracting Engineers,
15 Cortlandt St., New York. 38 Oliver St., Boston, Mass.



BROWN & SHARPE MFG. CO.,

PROVIDENCE, R. I., U. S. A.



Special form Cutters are the most economical for the manufacture of duplicate parts. They can be sharpened by grinding without changing their form.

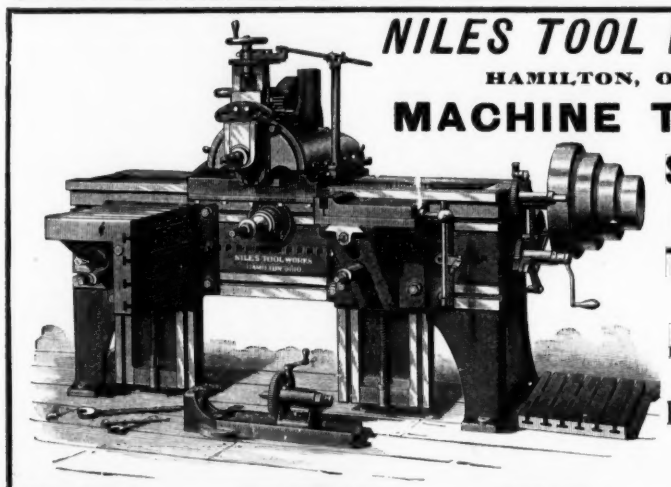
S. A. SMITH,

WESTERN REPRESENTATIVE,

23 SOUTH CANAL STREET, CHICAGO, ILL.

NILES TOOL WORKS,

HAMILTON, OHIO.



MACHINE TOOLS.

SHAPING MACHINES. TRAVELING HEAD.

16, 18 and 24 inch Stroke.

Extra heavy and powerful.

NEW YORK, 99 Liberty St. **PHILADELPHIA,** 705 Arch St. **CHICAGO,** Phenix Building. **PITTSBURGH,** Lewis Block.

GRANES

THE YALE & TOWNE MFG CO.
STAMFORD CONN
NEW YORK CHICAGO PHILA BOSTON

JENKINS BROS.' VALVES.

Every valve tested and warranted, all parts interchangeable
Nothing but best Steam Metal used in the manufacture
Jenkins Eyed Stuffing Box and Disc Removing Lock Nut
Is used only in the Jenkins Bros.' Valves.
None are genuine unless stamped with "Trade Mark."
Should you order INSIST on having Jenkins Bros.' **Valves.**

71 JOHN STREET, NEW YORK. *54 DEARBORN STREET, CHICAGO.*
21 NORTH FIFTH STREET, PHILA. *105 MILK STREET, BOSTON*

$150.00 REWARD.

The remarkable increase in the sale of our Improved Machine Tools has induced us to still further place their merits before every user of this class of machinery both in America and Europe.

In order to accomplish this we desire an advertisement out of the stereotyped order.

In view of this fact we will, on July 1st, 1891, pay one hundred dollars ($100.00) for the first and fifty dollars ($50.00) for the second best plan for advertising our line of Improved Tools.

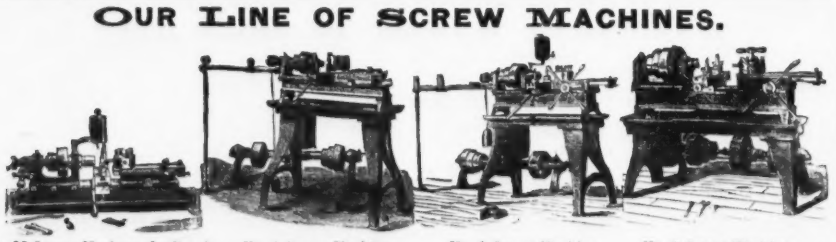
The plans must embody three conditions: First, they must be **NOVEL**; Second, **FEASIBLE**; Third, Cost must justify the advertisement being used in large lots.

Competition open to every one, except those in our employ. Communications may be addressed to either of our houses.

Eastern House, No. 64 CORTLANDT STREET, New York City. **The Lodge & Davis Machine Tool Co.,** Works: CINCINNATI, OHIO. Western House, No. 68 & 70 S. CANAL ST., Chicago, Ill.

N. B.—See "Advertisement," page 16.

OUR LINE OF SCREW MACHINES.



No. 00 Screw Machine, for Bench. No. 1 Screw Machine. No. 2 Screw Machine. No. 3 Screw Machine.

Can Furnish with or without Wire Feed.

THE CARVIN MACHINE COMPANY,

Manufacturers of, and Dealers in, all kinds of

MACHINERY AND MACHINE TOOLS.

Universal and Plain Milling Machines, Drill Presses, Screw Machines, Hand and Engine Lathes, Planers, Profilers, Chucking Machines,

Gear Cutters, Die and Cutter Grinders, Tapping Machines, Wire-Spring Coilers, Milling Cutters, &c.

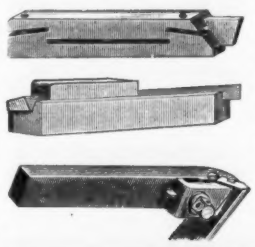
Plants for Manufacturers of Sewing Machines & Electrical Goods.

GEAR-CUTTING AND MILLING IN ALL ITS BRANCHES.

Laight & Canal Sts. [Catalogue sent on Application.] **NEW YORK.**

THE PRATT & WHITNEY CO.,

HARTFORD, CONN., U. S. A.



Ask those who wish to reduce expense in manufacturing to try **Holders with Inserted Cutters, instead of Forged Tools,** in Lathes and Planers for Turning, Threading, Shaping, and Boring Metals. The cutters are inexpensive and may be sharpened by grinding without changing the form.

CIRCULARS AND PRICES FURNISHED UPON APPLICATION.

THE BILLINGS & SPENCER CO.

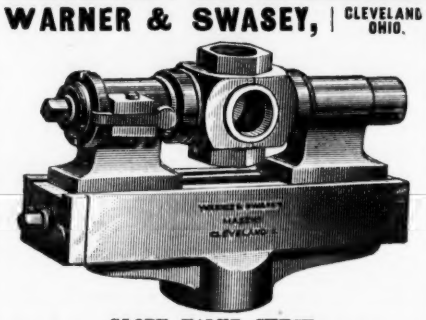
HARTFORD, CONN. U.S.A.

MANUFACTURERS OF BILLINGS' DROP FORGED LATHE DOGS FORGED FROM BEST STEEL FOR THE PURPOSE

IN 12 SIZES 3/8 UP TO AND INCLUDING 4 IN ALSO CLAMP AND DIE DOGS

DROP FORGINGS OF COPPER, IRON AND, STEEL OF ALL DESCRIPTIONS

WARNER & SWASEY, CLEVELAND OHIO.

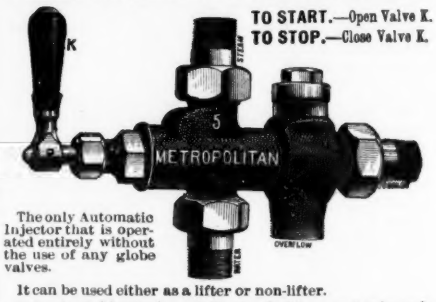


GLOBE VALVE CHUCK.

BRASS WORKING MACHINERY

ILLUSTRATED CATALOGUE ON APPLICATION.

THE METROPOLITAN AUTOMATIC INJECTOR



TO START.—Open Valve K.
TO STOP.—Close Valve K.

The only Automatic Injector that is operated entirely without the use of any globe valves.

It can be used either as a lifter or non-lifter.

It is adopted by the largest Engine Builders, and is for sale by the LARGEST SUPPLY HOUSES IN THE U. S.

Ask your dealer or send to us for circular and prices.

The Hayden & Derby Mfg. Co.,

No. 111 Liberty St., New York.

WESTERN AGENTS:

Marinette Iron Works Co., Chicago, Ill.
Robinson & Cary Co., St. Paul, Minn.
English, Morse & Co., Kansas City, Mo.
J. M. Arthur & Co., Portland, Oregon.

GEO. W. FIFIELD,

Manufacturer of ENGINE LATHES from 16 to 48 in. swing. Cuts, Photographs and Prices furnished on application.

Lowell, Mass., U. S. A.

OUR 1891 CATALOGUE is now ready. We should like to send this useful pamphlet to every machine shop or manufacturing concern in the country.

LEXINGTON (Mass.) GEAR WORKS.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

J. M. ALLEN, President.
Wm. B. Franklin, Vice-President.
F. B. ALLEN, Second Vice-President.
J. B. PIERCE, Secretary & Treasurer

Key-Seating Machines and 20 in. Drills

A SPECIALTY.

SEND FOR LIST OF

New and Second-Hand

Lathes, Planers, Drills, or anything in Machinists' Tools or Supplies.

W. P. DAVIS,
Rochester, N. Y.
Works at North Bloomfield.

Send for circulars describing our

NEW STYLE SPIRAL-GEARED PLANERS,

3 ft., 4 ft. and 5 ft. square.

Also our **"ORIGINAL"** Line 24", 26", 30", 32", 36", 42", 48", 56", 62".

THE G. A. GRAY CO.,
CINCINNATI, O.

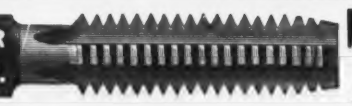
STEEL CASTINGS.

PRATT & LETCHWORTH,
PROPRIETORS
BUFFALO STEEL FOUNDRY,
BUFFALO, N. Y.

27" × 27" × 8' Planer. 20" × 6' Chucking Lathe. 16" × 6' Engine Lathe. 25" Pillar Shaper.

THE HENDEY MACHINE CO. TORRINGTON, CONN. MANUFACTURERS OF **MACHINE TOOLS.** SEND FOR OUR CATALOGUE.

J.M. CARPENTER PAWTUCKET, R.I.



Manufacturer —of— **TAPS & DIES**